



ANIMALS



BIRDS



FISHES



REPTILES



VEGETABLE



MINERAL

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BERGE'S
COMPLETE NATURAL HISTORY

OF THE

Animal, Mineral, and Vegetable Kingdoms.

EDITED BY

R. F. CRAWFORD, F.S.S.

*WITH SIXTEEN LARGE COLOURED PLATES, AND OVER THREE HUNDRED
SMALLER ILLUSTRATIONS.*

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INTRODUCTION.

WE will take a walk a little way into the country. There is a quarry on the other side of the road, and we stroll across and look at the stone. It is lifeless, and is unable to absorb any nutriment. Consequently it does not grow, but only increases in size by accumulations on its exterior. All stones or minerals—for they form the Mineral Kingdom—are inorganic bodies.

But look, between the stones there are numerous shells of snails and mussels. How heavy they are! They are as heavy as the layers of bluish-grey limestone in which they are embedded, and are also similar in colour. These shells are the petrified remains of animals which inhabited the lakes and seas thousands of years ago. They furnish us with evidence of what the world was like formerly, and therefore arouse our greatest interest.

We will now go on a little farther. In front of us there is a meadow, which is crossed by a tiny silver brook, and beyond we see the beautiful woods. The flowers scent the air with sweet perfumes, and the leaves are rustling in the breeze. Listen, the blackbird is pouring out his sweet-toned melody. The butterflies flit

from tree to tree, around us the bees and flies are buzzing and humming, and over the brook the glittering green dragon-fly floats in the air.

Here we meet with plants and animals. The former compose the Vegetable Kingdom ; the latter, the Animal Kingdom. Both plants and animals can consume nutritious matters ; they grow from the interior, and reproduce their species. Besides the organs of nutrition and reproduction, animals have also organs of voluntary motion and organs of sense.

How glorious it is in the open air ! Our eyes are never tired of contemplating the beautiful colours and forms, and the lives and habits of the plants and animals. Nature lies before us as a marvellous work of the Creator, and we then feel a desire to penetrate deeper into its mysteries, and to study its lessons more earnestly.

Nature furnishes us with food and clothing, and provides us with remedies which are so necessary in our days of sickness. But many plants and animals are injurious to us, even dangerous to our lives.

Therefore we should strive to become acquainted with nature, which surrounds us on all sides, lest some day we should have reason to regret our ignorance.

TABLE OF CONTENTS.



THE ANIMAL KINGDOM.

CLASS I. THE MAMMALIA.

	PAGE
Division I. The Monkeys	17
„ II. The Bats	24
„ III. The Animals of Prey	25
(a) <i>Insect Eaters</i>	26
(b) <i>Animals of Prey proper</i>	29
„ IV. The Marsupials	45
„ V. The Rodents	46
„ VI. The Edentata, or Toothless Animals	53
„ VII. The Solipedes	55
„ VIII. The Ruminants	58
„ IX. The Ungulata	64
„ X. The Seals	68
„ XI. The Whales (Cetacea)	72

CLASS II. THE BIRDS.

Division I. The Birds of Prey	74
(a) <i>Diurnal</i>	74
(b) <i>Nocturnal</i>	77
„ II. The Climbing Birds	77

CLASS II. THE BIRDS (*continued*).

PAGE

Division III.	The Singing Birds	80
„ IV.	The Columbidae	93
„ V.	The Gallinaceous Birds	94
„ VI.	The Cursorcs	99
„ VII.	The Wading Birds, or Struthioncs .	101
„ VIII.	The Swimming Birds, or Natatores .	105

CLASS III. THE REPTILES.

Division I.	The Tortoises	108
„ II.	The Crocodiles and Alligators .	109
„ III.	The Lizards	109
„ IV.	The Serpents	113

CLASS IV. THE AMPHIBIA.

Division I.	The Frogs	116
„ II.	The Salamanders	118

CLASS V. THE FISHES.

Division I.	The Bony Fishes	119
„ II.	The Cartilaginous Fishes . . .	128
	Aquariums	130

CLASS VI. THE INSECTS.

Division I.	The Beetles (Coleoptera) . . .	134
„ II.	The Hymenoptera	148
„ III.	The Lepidoptera	154
„ IV.	The Diptera	173
„ V.	The Hemiptera	173
„ VI.	The Neuroptera	174
„ VII.	The Orthoptera	175

Table of Contents.

9

	PAGE
CLASS VII. THE MYRIOPODA	176
„ VIII. THE ARACHNIDA	179
„ IX. THE CRUSTACEA	180
„ X. THE WORMS	181
„ XI. THE MOLLUSCS	182
„ XII. THE RADIATA	184
„ XIII. THE POLYPS	187
„ XIV. THE INFUSORIA	188

THE VEGETABLE KINGDOM.

CLASS I. FRUIT TREES	189
„ II. FOREST TREES	192
„ III. SHRUBS	203
„ IV. EXOTIC TREES AND SHRUBS	209
„ V. KITCHEN VEGETABLES	214
„ VI. FIBRE PLANTS USED FOR SPINNING	215
„ VII. PLANTS USED IN COMMERCE	217
„ VIII. ORNAMENTAL PLANTS	220
„ IX. FODDER PLANTS	220
„ X. POISONOUS PLANTS	221
„ XI. WILD-GROWING PLANTS AND WEEDS.	
I. Growing in Woods	228
II. Growing in Hedges and Bushes	229
III. Growing in Meadows	230
IV. Growing on Highways, Waste Strips of Land, and Rubbish Heaps	232

CLASS XII.	GRAMINACEÆ, OR GRASSES.	PAGE
I.	Cereals	234
II.	Grasses proper	237
„ XIII.	CRYPTOGAMS	237
	Herbarium	242
	<i>THE MINERAL KINGDOM.</i>	244
	COLLECTION OF MINERALS AND FOSSILS	254

INDEX TO COLOURED PLATES.

PLATE I.

1. Orang-outan.
2. Douc.
3. Black Baboon.
4. Drill.
5. Howling Monkey.
6. Bat.
7. Water Shrewmouse.
8. Dwarf Shrewmouse.
9. Lion.
10. Tiger.
11. Jaguar.
12. Lynx.
13. Hyæna Dog.
14. Jackal.
15. Fox.
16. Ichneumon.

PLATE II.

1. Tree Marten.
2. Otter.
3. Badger.
4. Raccoon.
5. Polar Bear.
6. Giant Kangaroo.
7. Marmot.
8. Porcupine.
9. Hamster.
10. Sloth.
11. Armadillo.
12. Ant-eater.
13. Long-tailed Manis, or
Phatagin.

14. Zebra.
15. Dromedary.
16. Lama.
17. Musk-ox.
18. Giraffe.
19. Elk.

PLATE III.

1. Reindeer.
2. Ibex.
3. Chamois.
4. European Bison.
5. Elephant.
6. Rhinoceros.
7. Hippopotamus.
8. Tapir.
9. Seal.
10. Walrus.
11. Dolphin.
12. Whale.

PLATE IV.

1. Condor.
2. Bearded Vulture.
3. Osprey.
4. Goshawk.
5. Jer-falcon.
6. White Owl.
7. Brown Owl.
8. Grey Parrot.
9. Toucan.
10. Black Woodpecker.

11. Cuckoo.
12. Great Butcher Bird.
13. Wagtail.
14. Golden Oriole.
15. Wheat-ear.
16. Water Ousel.
17. Nightingale.
18. Black-cap.
19. Titmouse.
20. Cross-bill.
21. Chaffinch.
22. Goldfinch.
23. Greenfinch.
24. Lark.
25. Waxen Chatterer.
26. Bird of Paradise.
27. Jay.
28. Tree Creeper.
29. Nuthatch.

PLATE V.

1. Hoopoe.
2. Swallow.
3. Ring Dove.
4. Capercaillie.
5. Quail.
6. Argus Pheasant.
7. Ostrich.
8. Bustard.
9. Demoiselle Crane.
10. Common Coot.
11. Green Plover.
12. Oyster Catcher.
13. Lapwing.
14. Woodcock.
15. Bittern.
16. Adjutant Bird.
17. Ibis.
18. Flamingo.
19. Pelican.
20. Sea Swallow.
21. Laughing Gull.
22. Albatross.
23. Crested Grebe.

PLATE VI.

1. Mud Tortoise.
2. Alligator.
3. Common Lizard.
4. Blind Worm.
5. Flying Dragon.
6. Iguana.
7. Gecko.
8. Chameleon.
9. Rattlesnake.
10. Viper.
11. Boa-constrictor.
12. Ringed Snake.
13. Green Frog.
14. Common Frog.
15. Spotted Salamander.
16. Proteus.

PLATE VII.

1. Sea Bream.
2. Sea Surgeon.
3. Sea Bat.
4. Beaked Chaetodon.
5. Parrot Wrasse.
6. Common Carp.
7. Herring.
8. Pike.
9. Sheat Fish.
10. Gold Fish.
11. Cod.
12. Sea Lamprey.
13. Salmon.
14. Electric Eel.
15. Sturgeon.
16. Saw Fish.
17. Hammer-headed Shark.
18. White Shark.

PLATE VIII.

1. Bastard Sand Beetle.
2. Procrustes coriaceus.
3. Calosoma sycophanta.
4. Great Water Beetle.

5. Black Water Beetle.
6. Rove Beetle.
7. Burying Beetle.
8. Hister.
9. *Dermestes lardarius*.
10. Stag Beetle.
11. Horned Dung Beetle.
12. *Nasicornis* Beetle.
13. Fuller Beetle.
14. Giant *Euchroma*.
15. *Corymbetes*.
16. Glow Worm.
17. Bee-eater.
18. Spanish Fly.
19. Cockchafer.
20. Palm Weevil.
21. Fir Bark Beetle.
22. Common Bark Beetle.
23. Great Oak Beetle.
24. Musk Beetle.
25. *Clytus arcuatus*.
26. Great Poplar Beetle.

PLATE IX.

1. Swallow Tail.
2. Apollo.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
3. Great White Cabbage Butterfly.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
4. Brimstone Butterfly.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
5. The Brown Argus.
6. Common Blue Fritillary.
7. The Small Tortoiseshell Butterfly.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.

8. Peacock Butterfly.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
9. The Camberwell Beauty.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
10. Admiral.

PLATE X.

1. Painted Lady (*Vanessa cardui*).
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
2. Silver-spotted Fritillary.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
3. *Melanargia Galathea*.
4. *Satyrus Hermione*.
5. Death's Head.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
6. Poplar Sphinx.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
7. Peacock Moth.

PLATE XI.

1. *Macroglossa stellatarum*.
2. Humble Bee Sphinx.
3. *Zygæna filipendulæ*.
4. Tiger Moth.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.
5. *Bombyx neustria*.
 - a.* Caterpillar.
 - b.* Chrysalis.
 - c.* Butterfly.

6. Silkworm Moth.
7. *Lasiocampa quercifolia*.
8. *Lasiocampa pini*.
9. *Cnethocampa processionea*.
10. *Agrotis pronuba*.
11. *Moma Orion*.
12. *Catocala fraxini*.
13. *Catocala nupta*.
14. *Abraxas grossulariata*.
 - a. Caterpillar.
 - b. Chrysalis.
 - c. Butterfly.
15. *Hibernia defoliaria*.
16. *Tinea granella*.
17. *Pterophorus pentadactylus*.

PLATE XII.

1. Giant Wood Wasp.
2. Gad Fly.
3. Common Tree Bug.
4. Scorpion (Water Bug).
5. Lantern Fly.
6. Ant Lion.
7. Praying Mantis.
8. Migratory Locust.
9. Mole Cricket.
10. *Æschna grandis*.
11. Termite.
12. Variegated Crab.
13. Edible Crab.
14. River Crayfish.
15. Common Centipede.
16. Book Scorpion.
17. European Scorpion.
18. Common Garden Spider.
19. Tube Worm.
20. Tape Worm.
21. Paper Nautilus.
22. Common Cuttle Fish.

PLATE XIII.

1. Large Edible Snail.
2. Masked Snail.

3. Common Mud Snail.
4. Viviparous Marsh Snail.
5. Strombus.
6. Marble Whelk.
7. Rose Whelk.
8. Mitella.
9. Spider Whelk.
10. Wentletrap.
11. Common Janthine.
12. Haliotis.
13. Sea Hare.
14. Common Pholas.
15. Striped Sun Shell Fish.
16. Edible Limpet.
17. Great Scallop.
18. Sea Urchin.
19. Ophiura.
20. Physalis.
21. Madrepora.
22. Red Coral.
23. Red Sertularia.
24. Sertularia filicula.
25.)
26.) Infusoria.
27.)
28.)

PLATE XIV.

1. Barberry Shrub.
2. Pepper Plant.
3. Clove Tree.
4. Coffee Tree.
5. Chinese Tea Plant.
6. Bread-fruit Tree.
7. Cotton Shrub.
8. Tobacco Plant.
9. Succory, or Chicory.
10. Common Liquorice.
11. Bastard Saffron.
12. Passion Flower.
13. Spring Saffron.
14. Bird's-foot Trefoil.
15. Common Buckwheat.
16. Marsh Crowfoot.

- 17. Black Hellebore.
- 18. Water Hemlock.
- 19. Spotted Hemlock.

PLATE XV.

- 1. Monk's-hood.
- 2. Deadly Nightshade.
- 3. Henbane.
- 4. Thorn Apple.
- 5. Mezereon.
- 6. Purple Foxglove.
- 7. Paris quadrifolia.
- 8. Meadow Saffron.
- 9. Darnel.
- 10. Centaury.
- 11. Tansy.
- 12. Arum.
- 13. Tree Sorrel.
- 14. Shave Grass.

- 15. Wood Sorrel.
- 16. Sugar-cane.
- 17. Common Rice.
- 18. Common Millet.
- 19. Quaking Grass.

PLATE XVI.

- 1. Field Horse-tail.
- 2. Maiden-hair, or Wall Rue.
- 3. Fern.
- 4. Common Hair Moss.
- 5. Reindeer Moss.
- 6. Toad-stool.
- 7. Champignon.
- 8. Bovista nigrescens.
- 9. Edible Morel.
- 10. Poisonous Morel.
- 11. Cantharellus cibarius.



NATURAL HISTORY.

THE ANIMAL KINGDOM.

CLASS I.—MAMMALIA.

THE mammalia have a hard, bony skeleton and a vertebral column or backbone; warm red blood flows in their veins; they breathe by means of lungs, and suckle their young, which they bring forth alive. Their bodies are generally covered with hair. Upwards of three thousand species of mammalia are known.

DIVISION I.—THE MONKEY TRIBE.

The monkeys are distinguished from the other animals by their docility, and, more especially, by their power of imitation. They are a caricature of man, created, as it were, to show him into what he would develop if he permitted his sensual impulses to overrule his reason. This accounts for our being unable to look at monkeys without some feelings of dislike. It is evident at the first glance that they are nearer related to man than any other animal. The natives of the island of Java believe that the orang-outans are the offspring of the original inhabitants of that island, and that they are able

to talk, but remain silent lest they should be treated as slaves. Several nations of antiquity regarded the monkey as a divine animal.

The monkeys have long, loosely hanging arms, furnished with elongated, claw-like fingers; their feet resemble hands. They swing themselves with ease from branch to branch and from tree to tree; they are good climbers, and fetch down fruit from the topmost



Monkeys.

branches. But notwithstanding the aptitude of their hands for climbing, the latter cannot equal the dexterity of the human hand, which is justly described as the tool of all tools!

Monkeys differ outwardly from man in many respects: their foreheads are low, and almost disappear under the overhanging hair; their ears are directed upwards; their nose is exceedingly flat and scarcely projects; their teeth remind one of those of the animals of prey; their chin is receding; their entire skin is hairy, except in a few places; and their movements are very insecure, and in most kinds are only possible with the assistance of their long arms.

As far as regards the intellectual qualities of the monkeys, these are of no very high order. In this respect they are, at all events, surpassed by the dog,

the horse, and the elephant. There is especially no trace of those qualities of fidelity, attachment, and gratitude which we justly so highly value in the animals last mentioned. The monkey is false, thievish, and at times most disgusting in behaviour. Whoever has the opportunity of frequently observing this animal in menageries or zoological gardens will quickly come to the conclusion that the monkey is not only a caricature of man, but that it is also to be classed with the ugliest of animals.

There are over one hundred various kinds of monkeys, a few of which we will describe with a little more detail.

THE ORANG-OUTAN (*Simia satyrus*), Plate I., Fig. 1. —The orang-outan is found in the islands of Borneo and Sumatra. It attains to a height of four and a half feet. The face and the inside of its hands are hairless, and are of a bluish-grey tint; but the other parts of its body are covered more or less thickly with hair, generally of a rusty-brown colour. Its hands almost reach to the ground.

When at liberty it feeds only on plants, and especially on tree-fruits. Hard shelled-fruit, as big as a human head, which a man could only open by means of an axe, the orang-outan tears asunder with its hands. It is by no means so lively as the monkeys we are accustomed to see in menageries, and sits for hours at a time in a melancholy mood on the bough of a tree, only exhibiting the natural fierceness of its class when attacked.

In youth it is sociable, and lives with others of its kind, but when old it leads a more solitary life; the old males are especially fond of solitude. With increasing age the orang-outans scarcely ever climb the trees. On the

ground, however, they move with difficulty, and their gait is awkward and clumsy. They build a kind of nest in the thick branches nineteen or twenty feet above the ground. Their attachment to their young is very touching.

The following is an account of a captive female orang-outan :—

“ She was very good-natured, and never exhibited any malice or treachery. The hand could be put into her mouth without any fear. She had a sad and melancholy expression, and ate everything that was given her, but preferred fruit and spicy plants. She was equally partial to boiled or roasted meat and fish, and took raw eggs with pleasure ; but her greatest dainty seemed to be strawberries. Her usual drink was water, but she was also fond of all kinds of wine, and especially malaga. After drinking she wiped her lips with her hand as many men do, and even made use of a tooth-pick in the same way as a man would.

“ She made great preparations before going to sleep. Having first arranged some hay so as to form a couch, she shook the remainder together ; and, after placing a bundle under her head, covered herself with the rest. On one occasion the lock of her chain was opened with a key ; and, after attentively watching the operation, she took up a piece of wood, put it into the keyhole, and turned it round in all directions.”

The CHIMPANZEE (*Simia troglodytes*) attains to the same height as the orang-outan ; its body is covered with dark hair, and its hairless face is of a leathery yellow. It lives in forests, and is social and much livelier than the orang-outan, but it is also extraordinarily fierce. It builds hut-like constructions in the trees. The

chimpanzee cannot live longer than a few years in our climate.

The GORILLA (*Simia gorilla*) is the biggest monkey, growing to a height of six feet. Its grey, sparkling eyes are deeply sunk in the head, and the powerful bony forehead gives the face an expression of wild ferocity. The mouth is wide, and the lips are sharply cut, without any red at the edges; the jaws are extremely powerful, and are armed with strong incisor teeth. The eyes stand wide apart, and the nose is more prominent and the head better formed than is the case with the other monkeys. The gorilla would possess a more striking resemblance to man did not its broad shoulders, its bullet-shaped head without a neck, and the immense size of its stomach remind one of the gross form of a voracious animal of prey.

THE DOUC (*Semnopithecus nemæus*), Plate I., Fig. 2.—The douc, or variegated monkey, is a native of Cochin-China. Its tail is almost as long as its body. From its variegated external appearance this monkey might be called a clown; its jacket is grey; its breeches, head-band, and gloves are black; its stockings brownish red; its sleeves, beard, loins, and tail white; its face yellow; and its necktie brownish red.

It is timid and shy, and at the sight of man quickly makes off into the recesses of the forest. It does not live long in captivity.

THE PAPION (*Cynocephalus*).—The Greek name signifying “Dog’s-head” is very appropriate to the papions, for they resemble a dog both in the shape of the head and in the hairy covering of the skin, and even in the tone of the voice.

They are very powerful animals, with protruding snouts.

Their jaws, furnished with immense incisor teeth, would do honour to any beast of prey, and their whole expression is fierce and malicious. Their limbs are strikingly short in comparison with those of the monkeys mentioned above. The papions are found in Africa and the East Indian islands, and live chiefly in rocky and hilly regions, avoiding the woods as far as possible.

Their food consists of all kinds of plants, fruits, herbs, grasses, bulbs, etc., and also of small animals, especially snails, insects, and spiders. It may, therefore, easily be supposed that they can do a great deal of mischief in inhabited districts, more especially as they live in herds, and are much feared by man on account of their strength and fierceness. The structure of their body prevents them from walking upright, and their whole behaviour, whether at rest or when running and jumping, exhibits a malicious disposition.

The papions are, all of them, a bad lot; they are always fierce, bad-tempered, impudent, and malicious. They have a snout formed like that of a bull-dog, and their faces are repulsive. They have a sly look and a cruel disposition. These animals easily discover snares and dangers, and defend themselves against their enemies with courage and obstinacy. Notwithstanding the fierceness of their nature, they can be tamed and made obedient when young; but their innate malicious nature reappears in old age. They are then no longer obedient, but again grin, scratch, and bite.

There are various kinds of papions. The BLACK PAPION (*C. niger*), Plate I., Fig. 3, is found in several of the East Indian islands.

THE MANDRILL (*C. mormon*).—This monkey has a repulsive appearance. The high puffed-up cheeks are

blue with red lines, the nose a fiery red, the hair of the head greyish green, and the whiskers lemon yellow. It is as malicious and violent as it is rapacious, and is found on the west coast of Africa. It is much feared on account of its strength. As it feeds chiefly on plants, it frequently does a great deal of damage; troops of these animals are said to have invaded the inhabited districts on the coast.

The mandrill does not fear man, and is never to be frightened by a gun-shot; the smallest trifle suffices to put it in a most violent rage. We can, therefore, perfectly understand why the negroes do not dare to enter into the forests in which the mandrills are known to live.

The mandrill bears captivity well, but is never a favourite, on account of its repulsive behaviour and ferocity. Old mandrills can neither be kept in captivity nor tamed.

THE DRILL (*Cleucophaeus*), Plate I., Fig. 4, resembles the mandrill in its behaviour and habits. Its face is quite black; its coat more greenish. It also inhabits the same districts of Africa as the mandrill.

THE BLACK HOWLING MONKEY (*Mycetes niger*), Plate I., Fig. 5.—The coat of the male is black, that of the female rather brown. Their tails are what are known as prehensile tails, and are of great service to their owners when climbing. The howling monkeys are found in South America. They live chiefly in the dense, damp woods, and along the banks of rivers. Every morning and evening their dismal howling fills the hearer with horror. They sit or lie about in the trees, and sometimes hang from the boughs by means of their prehensile tails. Their faces have a serious expression, and are surrounded by long beards. Their

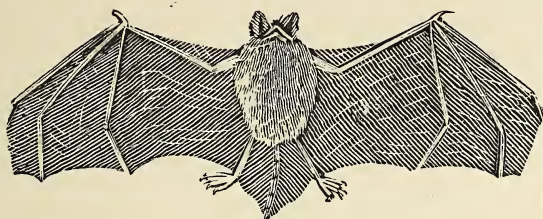
dismal chorus is begun by one of the old monkeys, and the whole company afterwards join in, the concert often lasting several hours. "One day," writes Schomburg, "I walked after breakfast towards the virgin forest, carrying my hunting equipment. The discordant chorus of the howling monkeys fell upon my ear, and quickened my eagerness for the hunt. I hastened straight on, regardless of obstacles, in the direction of the howling, and, after much trouble and searching, came unobserved upon the whole company. They were sitting upon the high trees in front of me, and were indulging in so horrid a concert that one might have supposed that all the wild beasts in the forests were engaged in a deadly struggle; nevertheless, it cannot be denied that there was a certain regularity of time in the howling chorus. On a given signal all the animals were silent, but when the leader again lifted up his inharmonious voice the howling began anew. For a few minutes the sounds were like the grunting of pigs, then they resembled the roaring of the jaguar when it attacks its prey, and afterwards the chorus became similar to the angry snarling of the same animal when it is at bay or in the presence of danger."

The Indians hunt the howling monkey and eat its flesh; but it very often escapes the hunter, even after having been mortally wounded; for while in the act of falling down from the tree it will twist its tail around a bough, and remain suspended long after death.

DIVISION II.—THE BATS.

The bats are strange-looking animals, being half mouse, half bird; their fore limbs are very long, and between these and the hind limbs, and also generally extending to the tail, there is a delicate membrane, which enables them to

fly. Their eyes are small ; their large ears erect ; their teeth sharp. The flight of the bats is swift and noiseless, but not enduring. They could not, like the migratory birds, fly off in the autumn towards warmer countries. Therefore in the winter they retire into clefts and



Bat.

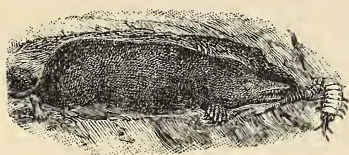
crannies, where they suspend themselves by the claws of their hind feet, and sleep until the rays of the spring sun warm their benumbed limbs. Our native bats feed upon insects, and are consequently useful. In the warm summer evenings they can be seen flitting around the blossoming lime trees in order to catch the honey-sucking moths. They do not build any nest for their young, but the latter cling between the folds of the wings of the parent animal, and are thus carried about by her on her excursions. Fig 6, Plate I., represents a bat in flight. The best known of the foreign kinds are the Vampire bat and the Colugo bat ; the former lives in South America, the latter is found in the East Indian Archipelago.

DIVISION III.—THE ANIMALS OF PREY.

The *animals of prey* proper are very powerful, and some of them are even dangerous to man ; they feed on the flesh of other animals. The *Insectivora*, or *insect eaters*, are, on the contrary, small ; they feed chiefly on insects and worms, and are therefore useful.

(a) INSECT EATERS.

The MOLE (*Talpa Europea*) inhabits meadows, fields, gardens, and forests, where it finds its food. It lives in the earth, and digs out its “runs,” at the same time throwing up mole-hills. The name mole signifies earth. The mole feeds on grubs,



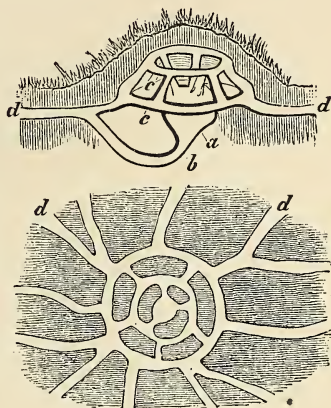
Mole.

caterpillars, chrysalises, maggots, crickets, lizards, snakes, frogs, mice, and rats, and does not even spare its own kindred. The formation of its body, which is about six inches long, enables it to seize these different kinds of prey with ease; for it is cylindrical and wedge-like in shape, with a long, flexible snout, and very large fore paws, furnished with five strong nails. Its head is placed deep between the shoulders—no neck is visible; its eyes are very small, and covered with hair; and there are no exterior ears. Its hind paws are longer but weaker than the fore limbs, and its tail is short. Its fur consists of short, velvety hair. The teeth of the mole are like those of the Carnivora, and number forty-four in all. There are six front teeth or grinders, six præmolars, eight molars, and two incisors in the upper jaw; and eight grinders, four præmolars, eight molars, and two incisors in the lower.

The mole nearly always lives a solitary life. It is very quarrelsome, fierce, and rapacious, and more sanguinary than the tiger. The weasel, fox, marten, hedgehog, owl, buzzard, falcon, raven, the viper, and man all threaten its life. Against these enemies it is, however, well protected by its dark fur, by the keenness of its senses

of hearing and smell, and by its rapid movements, and the ingenious architecture of its burrow. The latter is a real fortress. It consists :

(1) Of the chief structure, which is about two feet deep, below the roots of trees or ruined walls. This consists again of an almost spherical sitting-room (*a*), about four inches square, which is stuffed with grass and hay, from which leads a descending passage (*b*). Round the sitting-room there are two circular galleries (*c*), the upper one of which is connected with

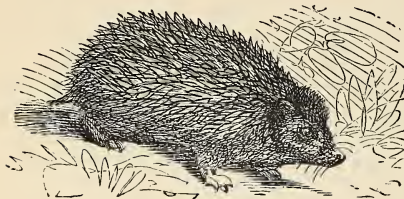


Section of Mole Hill.

the sitting-room. (2) Of a number of runs (*d*), which are twelve to sixteen inches long, and radiate in all directions; they are connected with each other by cross passages. (3) Of the chief passage, into which all the runs open in the form of arches, and which leads to the hunting grounds. (4) Of the hunting passages, which run in all directions.

In this burrow from four to six young ones about the size of a bean are born between the middle of April and June. The mother nurses them with the greatest tenderness, carrying them away in her mouth whenever danger threatens. But as soon as they are able to take care of themselves the parents drive them out of their home, and begin to lead a solitary life again. The mole is a very useful animal, because it destroys so many injurious insects. Although it does some harm by means of its mining operations, it is, nevertheless, more useful than destructive, and ought, therefore, not to be destroyed unless absolutely necessary.

THE HEDGEHOG (*Erinaceus Europæus*).—The hedgehog is likewise an inhabitant of the underground world, for



Hedgehog.

it lives in holes below the roots of trees, and under heaps of stones. Its body, with the exception of its belly, is covered with sharp spines, and its feet are short and strong. It

begins to hunt for its prey in the darkness of the night. Should it be disturbed, it will suddenly roll itself up into a ball, its sharp spines projecting in all directions. In this condition no dog can get at it; but, if water is poured on it, it will unroll again. Its spines are also of great service to it in other ways; for when rolled up it can let itself down the steepest precipices, and fall from walls ten feet high, without sustaining the smallest injury.

The hedgehog may also be called a useful animal; for it destroys mice, rats, and vermin of all kinds, and will even feed on vipers, as poison does not affect it. Its flesh is eaten in some countries, especially by the gipsies.

The SHREWMICE (*Sorex*) are small, and have a trunk-like snout. Cats do not eat them, on account of the musk-like scent which they emit from two glands situated on either side of their body. They feed on insects.

Plate I., Fig. 7, represents the WATER-SHREW (*S. fodiens*); Plate I., Fig. 8, DWARF-SHREW (*S. pygmæus*). The latter is the size of a cockchafer; it is the smallest of the mammalia, and is so voracious that when hungry it attacks and kills its own kind.

(b) *ANIMALS OF PREY PROPER.*

Of these several groups are distinguished : the cat-like, hyæna-like, dog-like, marten-like, and bear-like animals of prey.

THE LION (*Felis leo*), Plate I., Fig. 9.—The lion is covered with short, smooth hairs, which lie close to its skin. Its fur is mostly of a uniform yellow colour. The male has a long mane on its neck and breast. Its claws are retractile—*i.e.*, may be drawn back entirely into their sheaths. At the end of the tail is a horny point, which is surrounded by a tuft of hair.

The lion, the king of animals, inhabits the Old World, Africa, and Asia, and was formerly also found in Greece and Macedonia. The majesty of terror and violence accompanies its movements. Its most striking qualities are courage, pride, and circumspection. It chooses lonely spots with rocky caves for its habitation, where it passes the day in sleep. At the beginning of twilight it rises from its couch, stretches its limbs, and gives vent to a roar which makes man and beast tremble far and wide. Then it begins to roam through the neighbourhood ; and woe to the animal or man who approaches too near to it ! It crouches like the cat, and will sometimes spring more than twenty-nine feet. The results of such an attack are terrible ; for with one stroke of its paw it can kill a galloping horse, together with its rider. But it rarely attacks man. “ An African peasant, whilst taking a walk, fell in with a lion ; he fired at the brute, but missed it, and ran away ; being pursued by the lion and out of breath, he climbed up a stone heap and lifted the butt-end of his gun high up in the air. The lion lay down in front of the man at a distance of twenty paces. After about half

an hour it rose, receded at first slowly step by step, as if it wanted to sneak away, and, having proceeded some considerable distance in this fashion, it ran off at full speed."

The hunting of lions is very dangerous. In the neighbourhood of a Dutch farmer's estate in the Cape, a lion had established its den in a little wood grown over with thorns. One day it jumped over the high fences surrounding the farm, killed a strong ox, and sprang over the fences with the ox in its mouth, which it carried off into the thicket. The farmer followed it with some large dogs, but they could not drive it from the wood. During the next night the farmer remained on the watch close to his grounds; but the lion did not appear. On the following night he, together with another hunter, climbed a tree by the side of the road, which the lion had usually traversed when leaving its den. But the lion came from another direction to the farm, and whilst the hunters were waiting in the tree it carried away a valuable horse. Then the farmer, who was a man of strong nerve, made his way alone into the thicket. He could only get along with great difficulty, and had scarcely advanced fifty steps when he saw the remains of the horse, and close to them the lion. Within a distance of twenty paces the latter stood listening. As the farmer kept quiet the lion lay down. Then he gently cocked his double-barrelled gun, and raised it slowly in the direction where the lion lay. The slight noise had not escaped the watchfulness of the lion. It rose immediately. The sportsman then aimed between its eyes and fired. The animal fell on its back, but jumped up again in a moment, and roared frightfully. It then turned its flanks towards the clever marksman, and in another second received the

second bullet in its breast, when it rushed into the thicket in the agony of death.

The DOMESTIC CAT (*Felis domestica*) is known to everybody. Its nearest relation, the WILD CAT (*F. catus*), causes great destruction to game. It chiefly frequents the Carpathian Mountains. Domestic cats which have become wild are often mistaken for wild cats.



Cat.

The TIGER (*Felis tigris*), Plate I., Fig. 10, varies from a yellowish brown to a rust red in colour. It has neither a mane nor a tuft to its tail. Its length amounts in all to about eight feet of which thirty-two inches belong to the tail. This most terrible of all the animals of prey chiefly inhabits the south-eastern part of Asia. The tiger displays neither courage nor pride; but cowardice, cruelty, and malice, with no trace of majesty. Its strength and rapidity are astonishing. A tiger once jumped with a fearful bound on to the back of an elephant, tore an Englishman from the howdah, flung him to the ground, and ran off with him. All the companions of the unfortunate man turned their rifles in the direction of the running animal, but they dared not fire, for fear of hitting the man instead of the tiger, and were forced to leave him to his fate. This was fortunate; for the latter, who had become insensible owing to the fall from the elephant and extreme terror, was brought to by some thorns tearing his face and covering it with blood. Aware of his dangerous position, he had presence of mind enough to draw out a pistol from his belt, and to discharge it at the tiger. The shot missed, and the tiger gave him a stronger bite; but the plucky man did not lose all hope; he drew another pistol,

and shot at the shoulder blade of the animal. Fortunately the bullet this time pierced the animal's heart, and it fell down dead. Tigers, when driven by hunger, even enter the villages, and often force the inhabitants to retire altogether. They are especially fond of human flesh. When lying in ambush, their eyes sparkle through the darkness.



Tiger.

Horses scent them from long distances ; and fear of this terrible foe paralyses them. There are various ways of hunting this dangerous animal of prey.

THE JAGUAR (*Felis onca*), Plate I., Fig. 11.—The reddish-yellow fur of this animal is spotted with black. It inhabits South America, from Paraguay to Mexico, and is the largest and most dangerous animal of prey in those parts of the globe. The jaguar lies in wait for all sorts of

animals, and shows a great predilection for fish ; but most frequently it attacks grazing animals. It does not even hesitate to spring upon man.

THE COMMON LYNX (*Felix lynx*), Plate I., Fig. 12.—This animal, which is widely spread, is of a reddish grey, with darker spots on its upper parts and white on its lower parts. In Germany it has been entirely extirpated ; but is frequently seen upon the Alps, the Carpathian Mountains, and in the north of Europe and Asia. Hidden in the tops of low trees, it lies in wait for the passing animals, and springs even upon horses and stags. It commits great havoc amongst game, and is therefore eagerly hunted. Every year about fifty thousand furs of the common lynx and its nearest relations, the desert, polar, red, pardel, and bog lynx, are sold in the market.

THE SPOTTED HYÆNA (*Hyæna maculata*).—This whitish-grey and white-spotted animal attains a length of four feet, and has its home in Southern and Eastern Africa. It has a repulsive appearance, and emits a very disagreeable odour. Hyænas remain hidden during the daytime ; in the evening and during the night they go out in quest of prey. They are great cowards, and sometimes encircle human habitations in troops, and fall on their sleeping prey. Hyænas force their way even into the villages, clear off the decayed animal matter, and dig the corpses out of their shallow graves. They can be tamed, and then become domesticated and obedient.

The HYÆNA DOG (*Canis pictus*), Plate I., Fig. 13, does not belong to the hyænas, but to the dog-like animals of prey. It inhabits the central and southern parts of Africa, and is very dangerous to the antelopes and the herds of sheep ; it also attacks cattle.

THE WOLF (*Canis lupus*).—The fur of this animal is

yellowish grey with blackish spots; in its lower parts its colour is lighter. It is the size of a shepherd's dog. Its whole appearance is unprepossessing; its body



Wolf.

is lean and long; its expression malicious; its ears erect. When it cannot obtain its favourite food, game or sheep, it feeds on mice, frogs, and carrion. It sometimes attacks even horses, attempting by

a bold jump to seize them by the throat and pull them down. It knows how to avoid their kicks, and also how to secure itself against the horns of oxen. It is a coward, like the hyæna; but when hungry fears nothing. It carries away sheep under the very eyes of the shepherd, and even forces its way into stables. It is cunning and sly, and knows how to make use of the best opportunities. It is as strong as it is tenacious of life; with a sheep in its mouth it runs off at a trot; sometimes a dozen bullets are not sufficient to kill it.

The wolf was formerly spread all over Europe. At the present time it is still found in great numbers in Hungary, Galicia, Russia, and Scandinavia, in the Alps

and Pyrenees, the Ardennes and Vosges, and in the northern parts of America, Africa, and Asia, also in Central Asia. It sometimes becomes rabid.

Of the DOMESTIC DOG (*Canis familiaris*) there are more species to be found than of any other animal, varying, more or less, in colour, form, and size, as well as in intelligence. It is very docile for any kind of performance, serious or comical; its memory and its sense of localities and time are admirable. It is the constant companion of man, the protector of his house and of his herds, his help-mate in battle, a useful companion of the hunter, a draught animal, a guide, a buffoon, a postman, a successful searcher for truffles, a player of dominoes, a comedian, and a brother of charity at St. Bernard. What creature can do more? Amongst its characteristic qualities, its faithfulness and gratitude are most prominent. No animal is attached to man in the same degree.

Of the different breeds of dogs we will only mention the most important ones which are found in this country. Amongst sporting dogs the bloodhound stands pre-eminent for its majesty of appearance and beauty of colour, and is distinguished for the keenness of its scenting powers. The head of the bloodhound is long and narrow, and "peaked" on the top of the skull. There is much loose skin about the head, and the eye is sunken showing the red skin beneath it.

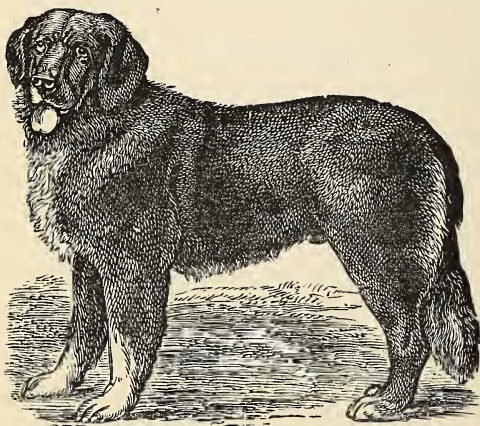
The greyhound, which is remarkable for its fleetness of foot, is used for coursing purposes; and, in addition to its beauty and elegance, is of a very affectionate disposition. Pointers and setters are much used by sportsmen in the field, and are possessed of keen scent and cunning. The retriever, which is useful for domestic as well as sporting purposes, is sagacious, good-tempered, and intelligent.

An English retriever, whether smooth or curly coated, should be black or black and tan, or black with tabby or brindled legs. Amongst the terriers, or vermin killers, the best-known varieties are the fox terrier, the Skye terrier, and the Irish, Dandie Dinmont, and Airedale terriers.

Spaniels are the oldest and the most useful generally of all breeds of sporting dogs ; earnest, untiring workmen in the field, and faithful, loving, and gentle companions when the day's work is done. They are also very beautiful and very taking dogs ; so that, upon the whole, it is no wonder that they are such universal favourites. The leading varieties are the black spaniel, the lurcher, the Clumber, the Sussex, and the Norfolk spaniels, and the Irish and English water spaniels.

Amongst other sporting dogs may be mentioned the dachshund, which is crooked-legged, jealous, and affectionate ; the basset-hound, the beagle, the otter-hound, the harrier, and the foxhound.

Amongst the large house dogs which are treasured as



St. Bernard.

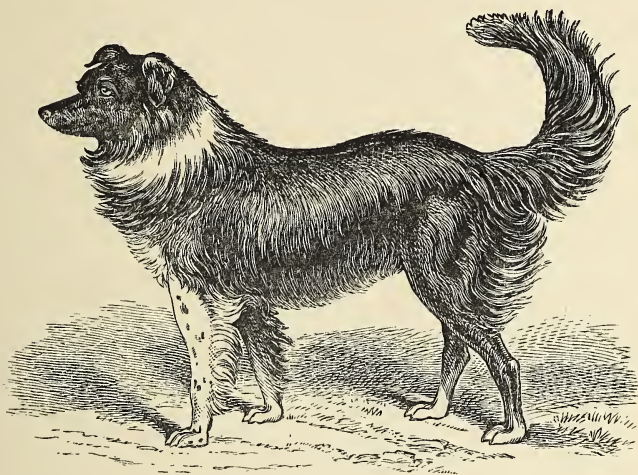
companions the most notable are the St. Bernard, the Newfoundland, and the mastiff. The St. Bernard is an extremely large and powerful fellow, a perfect giant amongst dogs, with a beautiful head and speaking countenance, in which sagacity is blended

with nobility, and a body of great symmetry, combining,

one might say, the agility of the Newfoundland with the strength of the British mastiff.

The Newfoundland, which is a capital swimmer, is a very large, jet-black dog, with a large and massive head, with a long, straight coat and bushy tail, and a face extremely expressive, and eyes that beam with intelligence.

The mastiff is a large dog, with a majestic-looking head, and is either fawn or brindle. The collie, which



Collie.

is *par excellence* the dog of Scotland, is a good companion, and a valuable sheep dog. The Dalmatian, which is white with black spots, is well known as a coach dog.

Amongst pet dogs we have the fondled King Charles spaniel; the poodle, which is a good performer of tricks; the active little pug; and the watchful Pomeranian.

The JACKAL (*Canis aureus*), Plate I., Fig. 14, is very similar in appearance to the fox. Its hair is of a dark rusty yellow, whitish on its lower parts. It inhabits Asia and North Africa, and is also found in the south-eastern

parts of Europe, in Greece, and Turkey. It makes its excursions during the night in troops. Like the hyæna, the jackal prowls round the herds and human habitations, and, failing living prey, is content with carrion.

THE FOX (*Canis vulpes*), Plate I., Fig. 15.—The common fox, also called red fox, has thick, soft fur, which is, on its upper parts, a light rust red, and on its lower parts whitish. Its body attains a length of twenty-eight inches. Its long tail is bushy, and ends in a white tip.

The fox is a common inhabitant of the whole of Europe, and of the northern parts of Asia, America, and Africa. It inhabits forests and woods, where it lives with its mate in caverns. In rapacity it is nearly equal to the wolf; but it can master its cupidity and wait for better opportunities if danger should threaten. No animal is the subject of so many fables. "Master Reynard" is always the cunning rogue, who outwits his adversaries. When exposed to fresh conditions, it knows how



Fox.

to find out new expedients, and is able to keep in check its innate habits and appetites. It always walks with its nose turned against the wind, and is acquainted with all hiding-places, hedges, and places of refuge. All the circumstances of a past danger are impressed on its memory. When it sees some new object, it approaches slowly; suspicion never leaves it. It can only be caught by means of a new bait; for, once having had experience of it, it can never again be used against it with success. It finds out the iron of the trap, and manages to take off the bait without suffering any injury. It is possessed of great powers of endurance; and, when attacked and

besieged in its burrow, will endure the most cruel hunger before it will venture out. Imminent death alone can force it to come out. And how difficult it is to kill it. It often runs off after being left for dead on the ground ; for courage and presence of mind never leave it. If the attacks of its enemies should become too harassing, it will emigrate from the district of its home, and choose another distant habitation. While running it looks out for the closest thicket. When it observes huntsmen in front, it never runs by them, but tries by all means in its power to get out of their reach, and often jumps over walls eight feet in height. Only on behalf of their young will the male as well as the female fox risk their lives ; intense love will then overcome every fear and precaution.

The fox hunts hares, fowls, geese, and ducks, and even fish ; but it always destroys a great number of mice, whereby the injury done by it is partly equalised. Its cover has always several exits. If found to be rather deep, it was not constructed by the fox, but by a badger, which either left its burrow willingly or was driven out by the new tenant. The fox is hunted in different ways.

THE ICHNEUMON (*Herpestes ichneumon*), Plate I., Fig. 16.—This animal is also called Pharaoh's rat. It inhabits Africa, and was considered a holy animal by the ancient Egyptians. The colour of its hair is greenish-grey, somewhat darker on the head and back. Its snout is rather short ; its tail ends in a tuft. It feeds on rats, mice, toads, frogs, and snakes, birds' eggs, and the eggs of crocodiles.

THE TREE MARTEN, OR NOBLE MARTEN (*Mustela martes*), Plate II., Fig. 1.—The tree marten has a yellowish-brown fur and a reddish-yellow patch across its breast. It inhabits Europe and the western parts of

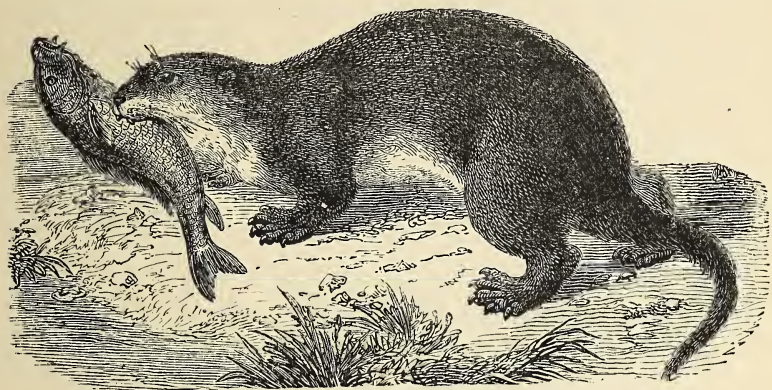
Asia. It is always found in forests, where it lies hidden in hollow trees. Keepers justly pursue it with eagerness, as it not only causes great destruction amongst game, but is also a great robber of useful birds. It also hunts squirrels, which, as soon as they get sight of it, try to escape as rapidly as possible. But the marten is just as clever as the squirrel in climbing trunks of trees, and in a short time it is at the heels of the frightened little animal. The latter then suddenly makes a jump; it stretches out its feet, and precipitates itself from the top of the highest trees. Its pursuer cannot imitate such a performance, and climbs down the stem again; but before it reaches the ground the squirrel is safe in the recesses of the forest.

Related to the tree marten are the Stone or House Marten (*M. foina*), which generally lives in the neighbourhood of human habitations, and destroys poultry and eggs: the Pole Cat (*Putorius fætidus*), which lives in the same localities and has the same injurious habits as the house marten: the small Weasel (*P. vulgaris*), is reddish brown on its upper parts, but on its lower parts whitish, and is over seven inches long. It is a useful animal, as it feeds chiefly on rats, mice, and badgers; it is also fond of eggs, which it carries under its chin: and the Great Weasel or Ermine (*P. ermineus*), the fur of which is of a dazzling white colour in the winter, and is the most valued of all furs.

THE FISH OTTER (*Lutra vulgaris*), Plate II., Fig. 2. —On the upper parts its fur, which is short, is dark brown, while on the lower parts it is lighter brown. Its body is thirty-two inches long, and its tail eight inches long; between its toes there are web membranes. The fish otter is rather an aquatic than a terrestrial animal. On land it is clumsy and uneasy in its movements,



but in the water quick and persevering. It hunts fish, and its excellent organs of sight greatly assist it in this hunt. It is very seldom seen, as it is very shy and constantly hiding, mostly committing its depredations during the night. Otter hunting is therefore difficult ;



Otter.

but in winter, when the snow has just fallen, and the water has been frozen over, one can easily find the spots where the fish otter enters the water. There it can be caught by means of a spear.

THE BADGER (*Meles taxus*), Plate II., Fig. 3.—The compact body of the badger is covered with blackish fur, with white stripes at the neck and head. It lives in forests, in the neighbourhood of fields and vineyards, where it digs burrows, with about six to eight passages leading to a kettle-shaped chamber, which lies from four to six feet under the surface. It sleeps in the daytime and during the winter, but at night it goes out on its predatory excursions. Its food consists of insects, worms, snails, frogs, snakes, birds' eggs, young birds, and young hares ; nor does it despise fruit, roots, and honey.

The badger is very wary, and defends itself with great courage in its burrow. It is hunted chiefly for its fur ; its flesh is rarely eaten. Paint brushes are made from its hair.

THE RACCOON (*Procyon lotor*), Plate II., Fig. 4.—Its fur is a yellowish-grey-black ; its body is about twenty-two inches long, and its tail ten inches. It inhabits North America, and feeds on fruit, birds' eggs, etc. It has received its name because it is in the habit of rinsing dry and blood-stained food before eating it, rubbing it between its fore paws. The eagerness with which it is hunted is best illustrated by the fact that every year about half a million of its furs are brought into the market. The flesh of the racoon is eaten, and its hair is used for paint brushes. It can easily be tamed, and is sometimes kept in houses.

THE POLAR BEAR (*Ursus maritimus*), Plate II., Fig. 5.—Its fur is quite white. Its body attains eight feet in length, and weighs from fifteen to sixteen hundredweights. It inhabits the most northern parts of Europe, Asia, and America. Its movements are equally quick in the water as on land ; and it is a terrible animal of prey, attacking even man with the greatest fury. It pursues its predatory excursions on the numerous islands of the northern polar regions, and its chief food is fish and seals. Sometimes it will come into more southern latitudes, when it causes terrible havoc amongst the herds, and only with the greatest difficulty can this strong and fearless animal be killed. The polar bear has its home in the regions of everlasting snow, and can only obtain the necessaries of life by means of never-ceasing activity. It often uses a sheet of ice as a raft to transport it to spots where it can obtain its prey. Its

flesh is eaten ; its fat is used for food and fuel, and its fur for carpets and sledge rugs.

The BROWN BEAR (*Ursus arctos*), also called the Common or European bear, has a shaggy light or dark brown fur. It is only about five feet long, and attains a weight from five to six hundredweights. Its home is in the temperate regions of Europe and Asia. Although not so strong as the polar bear, it is not to be despised as an adversary. It is the king of the northern forests. With one bound it springs from its hiding-place upon passing horses and cattle, fixes its teeth in their neck, and stifles them in its embrace, whereupon it carries them along great distances, even across ditches. When attacked it will place itself in an erect position, and try to tear its enemy with strokes of its paws. In the fables of animals it is represented as an awkward, foolish simpleton, who is always brought to shame and disgrace by the cunning of the fox. It can easily be tamed, and nearly everybody has seen it at a fair dancing to the sound of the bagpipes.

Its habitation is in caverns or hollow trees. During the winter it rests from four to five months ; yet this rest cannot be called a proper winter sleep, for during that period it sucks its paws. In the spring it comes forth again ; but at first in a very weak state, and with very unsteady movements. Its flesh is eaten, and its fur used like that of the polar bear.

DIVISION IV.—THE MARSUPIALS.

The marsupials have in the abdomen a pouch, a sort of bag or purse, in which they carry about their young, these being in a very backward state at birth. In some species the hind legs are developed to an extraordinary

degree, whereby they are enabled to jump great distances. Their original home is Australia; but several species are also found in America. They feed partly on plants, partly on animal matter.

THE GIANT KANGAROO (*Macropus giganteus*), Plate II., Fig. 6.—Its fur is greyish brown, somewhat lighter on the sides, while the lower parts are whitish. Its body is six feet long, and its tail nearly three feet. It inhabits Australia, and is found chiefly in New South Wales and Tasmania. It is the largest quadruped of that part of the globe. The front of its body is extremely slim in proportion to its hind quarters, and its hind legs are five times longer than the front ones. The kangaroo is a peaceful, shy, grazing animal. When startled it tries to get away from its pursuers by immense bounds. Its swiftness is so great that, at least across flat country, the fastest dog cannot come up with it. But when it is brought to bay it will defend itself most pertinaciously with its sharp claws, and with powerful strokes of its tail. It will seize even large dogs with its fore feet, and tear open their breasts and abdomens, often carrying them to neighbouring water to drown them. The flesh of the kangaroo is eaten; its hair makes a good fur.

DIVISION V.—THE RODENTS.

The rodents are for the most part small animals, but their want of size is compensated by their great numbers. They have in the upper as well as in the lower jaw two chisel-like incisors, no premolars, and from two to six molar teeth. The latter are separated from the incisors by a great gap. In the hares there are two little tack-

like teeth behind the incisors. The incisors wear away on the inside more than on the outside, so that they are always very sharp.

The rodents feed chiefly on plants. Some of them collect food for the winter; others sleep during the whole of that period. They inhabit all parts of the globe, but are more numerous in North America than anywhere else.

The COMMON SQUIRREL (*Sciurus vulgaris*) is, in the summer, brownish red on the upper parts and white on the lower parts; in the winter, brown red and light grey mixed. The black, white, and spotted squirrels are rare. The tail of the squirrel is bushy and arranged in two

lines of bristles; its ears are adorned with a tuft of hair. Squirrels inhabit the forests of Europe and of Northern Asia. They prefer the forests of trees with pointed leaves to those with broad leaves, and are always in motion, being equally clever in climbing, running, and



Squirrel.

jumping from tree to tree. They feed on nuts, acorns, seeds of fir trees, young shoots, young birds, and birds' eggs, and do a great deal of harm. They collect large stores for the winter, which they hide in hollow trees. Their nests are globular, and made of bark and leaves; they often build on the top of an old magpie's nest. Their greatest enemy is the tree marten.

The COMMON GARDEN SLEEPERS (*Elionymys nitela*) are

a reddish grey on their upper parts, lighter at the sides and white on the lower parts. There is a black ring drawn round the eyes, and in front and behind the ear is a white spot. They are found in the dense forests of the mountainous regions of Central and Western Europe. Their habits are similar to those of the squirrel; but they cause great damage to fruit, spoiling more than they consume, and are therefore justly trapped and hunted.

THE RELLMOUSE or SAT SQUIRREL (*Myoxus glis*) is similar to the garden sleeper in its mode of living, and with regard to the damage it does.

THE MARMOT (*Arctomys marmota*), Plate II., Fig. 7.—Its upper parts are brownish black, its sides yellowish grey, while its lower parts are reddish brown. It attains a length of sixteen inches, and is found in the Alps, Carpathian and Pyrenees Mountains, living chiefly on the sunny slopes near the limits of everlasting snow. The marmots live together in social troops in rocky caverns, and feed on the Alpine plants. If man approaches them they run swiftly into their habitations, and the hunters who pursue them for their flesh, fat, and fur must generally lie in ambush a long time before getting sight of their quarry. In the autumn the marmots move lower down the mountains into their winter quarters. There they sleep through the whole winter, huddled together in parties of three, five, and more, and apparently lifeless; the temperature of their blood then sinks to 44° F., their respirations are fifteen per hour; the pulse is hardly perceptible. In this state they can be rolled about like balls without being awakened. Marmots are easily tamed, and can be trained to perform many tricks.

THE BEAVER (*Castor fiber*).—On the upper parts the

fur is dark chestnut brown, while on the lower parts it is lighter; its tail is almost bare, scaly, and twelve inches long; the length of its whole body is thirty-two inches.

The beaver is to be found only in a few places in northern parts of Europe and Asia; but in North America a variety of this animal, the American beaver (*Castor Canadensis*), is still found in great numbers along



Beaver.

the eastern banks of the Missouri. It is now much hunted, as was formerly the European variety, and the number of beaver furs sold in the markets every year can be counted by thousands.

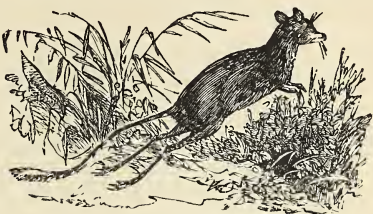
Beavers build their habitations, which contain many compartments, close to rivers and lakes. These lodges are frequently forty-five feet in length, and thirty-nine inches in height, and consist of branches, tree-trunks, and mud, and are divided into many different compartments. Such habitations are built in pairs, one above the other, and

lead into the water. As tools they use their fore feet and their sharp teeth, by means of which they fell stems of the thickness of twelve inches. They are shy, and do not leave their homes before darkness in search of their food, which consists of tender barks and different vegetable matter. For the winter they collect large stores of provisions. As the beavers are awkward on land, they try to save themselves by jumping quickly into the water when pursued. They are then in their own element, and are good swimmers and divers. They are caught by means of nets and traps, which are placed close to their lodges. Their soft furs are valuable. Castoreum, which is secreted by certain glands of their bodies, was formerly much valued, and was employed as an effective remedy in nervous diseases.

The PORCUPINE (*Hystrix cristata*), Plate II., Fig. 8, is a remarkable animal. It attains the size of a badger, and inhabits South Europe, Africa, and North America. Like the hedgehog, it is provided with a peculiar muscle, which enables it to erect its coat of spines whenever danger threatens, and it is thus protected against foxes and jackals, which often share the porcupine's habitation, and would very much like to devour their fellow-lodger. The black-and-white ringed spines or quills attain a length of from ten to twelve inches. The fore feet are furnished with sharp claws, which are very necessary to the animal for digging out its burrow. During the day the porcupines remain hidden in their burrows, but at night they go out in search of food. As their flesh is much liked, they are hunted in different ways. The Arabs try to drag them out of their holes by means of long, barbed poles. If they cannot reach them in that way, they send a boy clothed in leather garments down

into their passages, who drags out the struggling animal with much difficulty.

Rats and mice are the best-known animals amongst the rodents, which only too often molest us, and do a great deal of harm by their predatory habits. Of these we shall mention the domestic mouse (*Mus musculus*), a swift and pretty little animal, which is very much attached to our larder provisions; even



Kangaroo Rat.

the elephant, the largest amongst animals, fears this tiny rodent: the domestic rat (*Mus rattus*): and the brown rat, or Norway rat (*Mus decumanus*). The former became known in Europe in the twelfth century, and probably emigrated from Asia. At times a number of



Mice.

rats have been found with their tails grown together; such a company is called a rats' king. The brown rats did not appear in Europe until the last century. They are stronger than the domestic rats, which they drive away or devour. Their food generally consists in kitchen refuse of all sorts. If driven by hunger nothing

comes amiss to them, and they even eat their own kind. Their numbers are immense in large cities, especially in Paris, where they live in the subterranean passages. There they are killed in tens of thousands by special rat hunters.

The LEMMINGS (*Myodes lemmus*) live in the far north of Europe. These voracious little animals sometimes make migrations in vast numbers, swimming across rivers

and lakes, passing through towns and villages, and climbing over mountains and rocks. Troops of birds of prey fly above them, and they are followed by bears, foxes, martens, and weasels, so that their migratory flocks often disappear as rapidly as they make their appearance.

The HAMSTER or GERMAN MARMOT (*Cricetus frumentarius*), Plate II., Fig. 9, is brownish yellow on its upper parts. Its snout and the hair round its eyes and neck are reddish brown; the lower parts are black, and the feet white; its whole body measures ten to twelve inches in length.

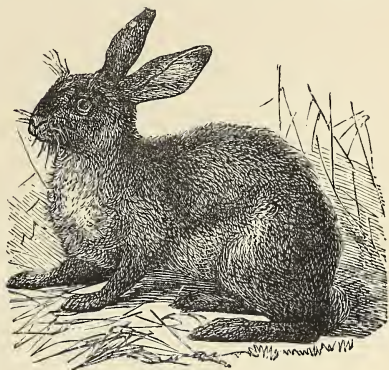
This injurious animal is widely spread over Northern Europe. In its mouth it has a pouch, in which it sometimes carries over fifty grains of corn into its burrow. The Hamsters, like true misers, are not social; if two of them meet, they attack each other with great fury, and fight until one of them lies dead on the field, when it is eaten by the victor.

The HARE (*Lepus timidus*) is of different colours, some brown, some grey, while others are whitish; its ears are long; behind its two front teeth, in the upper jaw, are two little tack-like teeth; its small tail is black and white, and its body about sixteen inches long.

The hare is found in Central and Southern Europe and Western Asia. It is very timid. A German proverb says, "Sleep is a troublesome business to the hare, and when it is awake it is full of cares and suspicion." It is rather a nocturnal than a diurnal animal; but in a quiet neighbourhood it is also seen during the day. It does not leave the district in which it was born unless it is forced to do so.

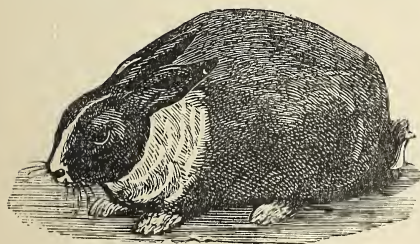
Hares multiply very rapidly, for they bring forth two to five young four or five times a year, for which they

construct a kind of nest. The old animals choose a somewhat hollowed-out spot as their habitation, where they are protected against the storms. As they are very fond of cultivated plants, such as clover, carrots, turnips, young corn, and the bark of young trees (especially of fruit trees), they do much damage in fields and woods. Their flesh is savoury, and their fur is used for making felt



Hare.

hats. The energy with which poor puss (hare) is hunted down is proved by the fact that every year about four and a half millions of hare-skins are sold in the different markets. Hares can easily be tamed when caught young. Closely related to the hare is—



Rabbit.

THE RABBIT (*Lepus cuniculus*).—The original home of these sprightly little animals was Spain and North Africa. In England only, rabbits

with silk-like hair are found, and they are kept by many people as domestic animals, and furnish many a Sunday dinner.

DIVISION VI.—THE EDENTATA, OR TOOTHLESS ANIMALS.

Some of the animals belonging to this division have no teeth at all, and all are without the front incisors. They are slow, stupid animals, and work only in the night-

time. They are all inhabitants of Brazil with the exception of two species. Nearly all are provided with very long claws. They live in trees or in subterraneous passages.

The SLOTH (*Bradypus pallidus*), Plate II., Fig. 10, also called "Ai," is reddish grey, its abdomen lighter. It is about sixteen inches in length, and has three long claws on each foot.

It inhabits the thickets of the virgin forests of Brazil, passing its life in laziness upon the tops of trees, the leaves of which form its food. During the day it hangs down asleep from a bough, and is then only discovered with difficulty. In the same position it creeps along the boughs, and does not leave the tree until the latter is stripped of all its leaves and fruits. When it descends to the ground it is very helpless, and can neither walk nor stand. It gives the best proof of its skill when climbing, hanging down from a bough by means of one of its feet, while it seizes the fruits with the other. It sometimes pierces the large snakes of Brazil with its long claws, so that they die from loss of blood. Its attachment to its young is very touching, and the mother carries them on her back from bough to bough. Its cry is like its name, Ai—a short "ah" and a long "ee."

THE LONG-TAILED ARMADILLO (*Dasypus peba*), Plate II., Fig. 11.—Its back is covered with a coat-of-mail, which consists, in the centre, of nine movable bony rings; some species have three, six, seven, twelve, or thirteen rings. It attains a length of fourteen inches, and lives in burrows which it digs out. In the evening twilight it roams in search of its food, which consists of insects, carrion, and roots. Its chief enemies are snakes, animals and birds of prey; the Indians also kill it on account of its savoury flesh. They use its coat-of-mail as a basket.

The TAMANOIR, or GREAT ANT-EATER, or ANT-BEAR (*Myrmecophaga jubata*), Plate II., Fig. 12, attains a length of six feet six inches, of which its long-haired, plumy tail takes twenty-eight inches. The colour of its hair is blackish brown ; it can project its worm-like tongue to a distance of sixteen inches.

The ant-bear inhabits the same regions as the sloth. It feeds on ants and termites. Raking up the habitations of these insects with its sharp claws, it inserts its proboscis, and begins to work with its viscous (sticky) tongue, to which hundreds of ants remain sticking ; and, as it licks its tongue free from the insects in one minute, it can easily be seen how this large animal derives sufficient food from these little creatures.

The PHATAGIN or LONG-TAILED MANIS (*Manis longicaudata*), Plate II., Fig. 13, is covered with dark-brown scales, which are arranged one above the other like tiles. It is a native of various parts of India and Africa, and resembles the ant-bear in its habits. When danger approaches it does not run away, but coils itself together. It is hunted on account of its flesh.

DIVISION VII.—THE SOLIPEDES.

The animals belonging to this division are large and powerful ; their limbs end in one toe, which is enveloped by a horny hoof. On their necks they have a mane, and their tails are covered with long hair. They feed on plants.

The HORSE (*Equus caballus*) has thick hair-lying close to the skin, and is variously coloured. Its neck is adorned with a long mane, and its tail covered from its base with long hair. Its ears are erect ; its eyes large and sparkling, and its nostrils wide. It has grinders and molar teeth, between which there is a great gap,

serving for the reception of the bridle-bit. In the jaw of male horses there is a small incisor. The horse is spread over the whole globe. As with dogs, many



Horse.

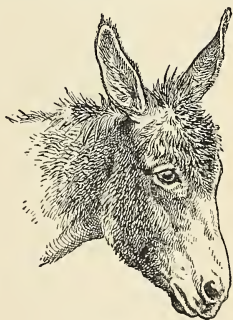
varieties of horses have been obtained by breeding, of which the following are the principal :—The Arabian, Persian, English, Hungarian, Russian, Holstein, and Norman horses. “The horse is not only a fiery racer ; it also displays all the noble characteristics of fidelity, gratitude, attachment, and compassion ; it exhibits a talent for understanding, an almost unfailing memory, and a very rare docility. It draws waggons and ploughs, tugs ships and guns, delights the curious crowd with its clever performances in circuses, and turns the wheels in factories, working like a machine in its self-renunciation. But it shows to the greatest advantage when carrying the horseman in war or on peaceful errands. It is then that it shows its great vigour and attachment. The horse quickly scents danger, and warns its rider. It rushes with him upon the enemy, seizing the latter with its teeth ; and it will remain standing by the side of its slain master, sadly neighing, for he has often called his steed by name, and caressed it and conversed with it on solitary rides.”

The colour of horses is said not to be without influence upon their character and temperament. “An Arab was once pursued by his enemies. He turned to his son and asked him : ‘Of what colour are the front horses of the enemy ?’ ‘White !’ was the answer. ‘Well,’ the old man said, ‘let us then ride in the direction of the sun ; they will melt like butter.’ An hour later the father

again asked his son: 'Of what colour are the front horses of the enemy?' 'Black!' the son called out. 'Well, then, let us ride over stony ground, and we shall have nothing to fear; for they are like the negresses of Soudan, whose naked feet stumble on the pebbles.' The fugitives again changed their course, and soon left their pursuers far behind. For the third time the Arab asked: 'Which are now the front horses of the enemy?' 'The brown ones and the chestnut horses!' replied the son. 'Forward, then, forward, children!' the father cried. 'Set spurs to your steeds! For, in good truth, the enemies' horses would overtake us if we had not given plenty of barley to our racers throughout the whole summer, as the Prophet commanded!'"

The nearest relative to the horse is the DONKEY (*Equus asinus*). It is used as a domestic animal in Southern Europe, but chiefly in Persia, Arabia, and Egypt, and better taken care of than with us in Europe. Its hair is grey; its ears are nearly half the length of its head.

Its bony appearance resembles that of the ox. The expression of its face shows apathy and obstinacy. Even its ill-sounding voice—a long-drawn Ee-ah—betrays wilfulness. Nevertheless, the donkey is patient, dispassionate, and easily satisfied; in carrying burdens it is not inferior to the horse; its elegantly shaped hoofs tread slowly indeed, but are sure and persevering. Its caution and patience have been mistaken for stupidity. There exists, indeed, hardly a braver and more useful creature. MULES are a cross breed between horses and donkeys.



Donkey.

The ZEBRA (*Equus zebra*), Plate II., Fig. 14, is a native of South Africa; lives in troops, and is very swift and savage, and therefore difficult to tame. Its general colour is creamy white, marked with black cross-stripes. It is hunted by the natives for the sake of its beautiful fur and its savoury flesh, and is also a favourite food of the lion.

DIVISION VIII.—THE RUMINANTS.

To the family of the ruminants belong for the most part large animals of different appearance. The ox is bulky, the antelope is slim and elegant, the hog is proud, the camel and the giraffe are odd-looking. They all, without exception, feed on plants, and several species live in troops. They have neither incisors nor præ-molars in their upper jaw. Their stomachs are divided into four compartments, and contain an arrangement for regurgitating the food into the mouth previous to its mastication and digestion. Their feet end in two toes, each of which is enveloped by a separate hoof. The ruminants are of the greatest value to man, who eats their flesh and drinks their milk, clothes himself with their wool and skin, and makes use of them as beasts of burden and draught animals. This order is divided into ruminants with and without horns. The camel (*Camelus*), called by the Arabs "the ship of the desert," is a misshaped animal. It is larger than a horse, and covered with reddish and yellowish hair. There are two species of camels—the dromedary (*C. dromedarius*), Plate II., Fig. 15; and the Bactrian camel (*C. bactrianus*). The former is a native of Africa, and has only one hump; the latter inhabits Asia (Tartary and Mongolia), and has two humps.

The camel is most easily satisfied, bearing hunger and thirst for a long time, and tramping, with apparently little exertion, with heavy burdens across the hot sands of the desert. It is as vigorous as it is patient, a symbol of resignation to a hard fate. Even when it is nearly exhausted under its burden it does not require the whip. The monotonous sound of a whistle, even the harsh voice of its driver, instils it with renewed vigour. The persevering animal traverses the most arduous routes for several weeks without a day of rest, carrying a burden of five to eight hundredweights, and receiving but scanty food. A few thistles or the shoots of a mimosa are sufficient to refresh it. It is stated that the caravans which start from the west coast of Africa are travelling from eight to ten days, during which period the camels are without water. The camel is the most useful and important of all the African domestic animals; without it commerce would be impossible across some districts which are nearly devoid of water and plants.

The LAMA (*Auchenia lama*), Plate II., Fig. 16, a native of the mountainous regions of South America, is much smaller than the camel. It lives partly in a wild state in troops; partly tamed. Its hair is of various colours. It is, like the camel, very useful as a beast of burden, and on account of its wool, flesh, and milk. The reader of the story of "Robinson Crusoe" will remember that a lama with its two young ones were his first household companions.

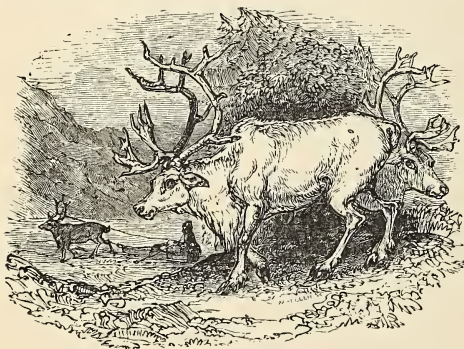
The MUSK-ox (*Ovibos moschatus*), Plate II., Fig. 17, belongs to the smallest ruminants. Its home is in the high mountains of Central Asia. The male has in its upper jaw two incisors in the shape of tusks, and in a gland of its abdomen the well-known, strong-scented

musk. In the forests of the Himalayas it is found at elevations of upwards of eight thousand five hundred feet.

THE GIRAFFE (*Camelopardalis giraffa*), Plate II., Fig. 18.—This strange-looking animal has the head of the horse, the neck and hoof of the stag, the callous breast of the camel, and the spotted skin of the panther. On its forehead it has two horny excrescences. It attains a height of sixteen feet.

The giraffe lives in the wooded plains of Central Africa, feeds on the leaves of trees, and is generally seen in small troops. Its rapidity is extraordinary; not even the Arabian horse can overtake it. It is often attacked by the lion, which lies in wait for it near the rivers and springs, where it comes to drink.

THE ELK (*Cervus alces*), Plate II., Fig. 19.—This animal is the largest representative of the genus of stags. It is the size of a horse, and its head is adorned with large antlers. The elk inhabits the northern regions of Europe and America. In California it has



Reindeer.

been seen in herds numbering about two thousand. It is hunted for the sake of its excellent flesh; but the hunting of this strong and swift animal is attended with many dangers. It swims across the largest rivers.

THE REINDEER (*Cervus tarandus*), Plate III., Fig. 1, is in the summer dark grey or brown, and in the winter

light grey or white. It is much smaller than the elk, and is gentle and peaceful, and runs with amazing swiftness. The reindeer is a native of the northern regions of Europe, Asia, and America. It can easily be tamed, and is generally found in large herds. Its food consists of reindeer-moss. To the inhabitants of the far North this animal is indispensable, for it supplies them with milk, flesh, and skin; its sinews they make into thread, its intestines into ropes, and its bones and horns into household utensils, spears, and fishing-rods.

THE FALLOW DEER (*Cervus capreolus*).—Nearly everybody has seen this graceful animal. It is found all over Europe, and in the western and northern regions of Asia. It attains the size of a small goat. The head of the male, the roebuck, is adorned with small but strong antlers, which are shed every year at the end of autumn. The fallow deer go about in troops, and feed on grass, clover, corn, and fruit. Their young are called kids, and the females, does. They are hunted for the sake of their flesh.



Fallow Deer.

THE STAG OR RED DEER (*Cervus elaphus*) is much larger than the fallow deer, and is the grandest animal of the higher species of game. The male carries large, branching antlers, which it loses in February of each year. The antlers of the one-year-old stag are like a spear, in the second year they are fork-shaped, and in those appearing later two more prongs or snags are added

each year. The stag has a greyish-brown fur. During the day it remains in the recesses of the forests ;



Stag.

in the evening and night it roams in herds in search of food, which consists of various grasses and herbs, and the twigs and bark of trees. It runs with great swiftness when scenting danger, and will wade through rivers and lakes. It often does great damage to vegetation and young trees. It is hunted for its flesh, fur, and antlers.

THE GOAT (*Capra hircus*).—"The cow of poor people" is found in all parts of the globe as a domestic animal. It has a beard on its chin, and carries sharp-edged horns, which incline towards its back. It is much given to butting ; but, nevertheless, it can be trained to draw vehicles and to perform tricks. When well fed and properly cared for, it will furnish a large supply of good milk, from which cheese is made. Its flesh is eaten, but is inferior to that of the sheep. Of its skin good gloves can be made. The curled, silky hair of the Angora goat, and the smooth, woollen hair of the Cashmere goat, supply the materials for valuable textile stuffs.



Goat.

THE SHEEP (*Ovis aries*).—The male is called "ram," the female "ewe ;" the former has large, twisted horns, bent backwards and sideways ; the female is without horns. There are different breeds of sheep, some of

which have longer and finer hair and better-formed horns than others. The finest breeds are of the most use, on account of their wool, flesh, and skin being of a better quality. In the summer they are driven out to feed on the pasture, and in the winter they are generally kept in stables. Their good-nature, gentleness, and patience have become proverbial; it is therefore not to be wondered at that they are the pets of children, and that the playful gambols and antics of the lambs amuse young and old alike.



Sheep.

The IBEX or WILD GOAT (*Capra ibex*), Plate III., Fig. 2, has a greyish-yellow, long fur, and powerful horns bent obliquely backwards. It is a true mountain animal, and was formerly spread all over the Swiss and Tyrolese Alps, but is at present found only to the number of about three hundred in the south-western portion of the Alps belonging to Italy.

The CHAMOIS (*Capella rupicapra*), Plate III., Fig. 3, attains the size of a goat. It is red in the summer, and dark brown in the winter, the lower portion of the body being lighter, while a dark, brownish-black band reaches from the corner of the mouth to the eyes. It has small, erect horns, which are curved backwards at the tips. The chamois is found in herds, numbering from five to twenty, in the Carpathian Mountains, the Pyrenees, and the Abruzzi Apennines; but most frequently in the Alps of Bavaria and Styria. It feeds on the buds of Alpine herbs and trees. When pursued it will leap down the most precipitous cliffs. There are many bold hunters who are passionately fond of this laborious and dangerous

chase. The peculiar flavour of the flesh of these animals, especially of the young ones, is greatly appreciated by many persons. Out of their skin a leather is manufactured noted for its softness. The horns are utilised for stick-handles.

To this division belong also the swift-footed antelopes and gazelles; the gnu, a native of the plains of South Africa, which is very savage, and cannot be tamed; and the ox, one of our most useful domestic animals. Oxen vary in colour and size, and supply us with milk, butter, cheese, flesh, and tallow; they are also used for drawing waggons and ploughs.

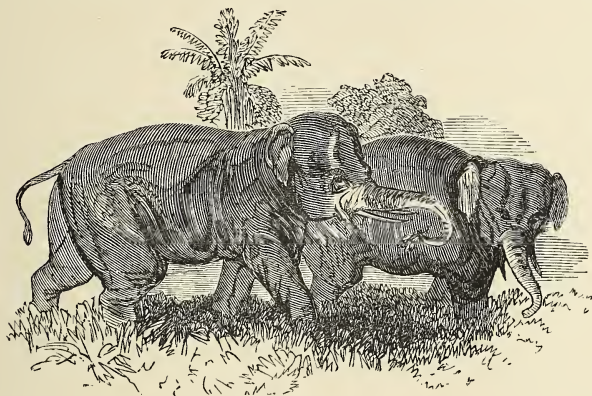
The URUS (*Bos primigenus*), formerly spread all over Germany, has been exterminated these two hundred years. The Germans in olden times were bold hunters, but they could not capture the uri by a free chase, but only by means of pits, which they covered with brushwood, moss, and leaves. The nearest relations to the urus are the European bison (*Bison Europæus*), Plate III., Fig. 4, the greatest animal of Europe (it is now only found in Lithuania to the number of from seven to eight hundred head); and the American bison (*B. Americanus*), similar to the above, which is still found to the west of the Mississippi, and along the Upper Missouri; but it also is likely to become exterminated.

DIVISION IX.—THE UNGULATA.

Part of the animals belonging to this division are of immense size, and are very thick-skinned and scantily covered with hair; they are therefore called “Pachydermata.”

THE ELEPHANT (*Elephas*).—There are two species:

the African elephant (Plate III., Fig. 5), and the Indian Elephant (*Elephas Africanus*, *Elephas Indicus*). The elephant is the largest of the land animals. It has been known to live from one hundred to four hundred years, and weighs from sixty to eighty hundredweights. Its height reaches ten feet, its length from thirteen to sixteen feet. Its thick, wrinkled skin is covered with a few bristles. The eyes are small, the ears large, and its nose is prolonged into a long, flexible trunk. In the



Elephants.

upper jaw of the male animal are two tusks (or thrusting teeth), which are from three to six feet long, and from thirty to seventy hundredweights in weight; these furnish valuable ivory. The tail is long, and has at its end a tuft of coarse bristles. The elephant is a native of Central Africa.

The Indian elephant lives in herds of from thirty to two hundred, and is fond of marshy districts. It feeds, in its wild state, on the leaves and twigs of trees, and is a harmless, peaceable animal, so long as it is not provoked. It does great harm to the plantations of rice, sugar, and coffee whenever it forces its way through them. Its

docility and prudence are astonishing ; its senses of smell and hearing are also greatly developed. The first elephants are mentioned in the history of Alexander the Great. He brought three hundred of them from India to Babylon. At present they are seldom used as domestic animals, although many are still kept for that purpose in Ceylon. They are eagerly hunted for their tusks. About ten thousand are said to be killed annually. From Africa alone upwards of twelve thousand hundredweights of ivory, valued at £600,000 to £800,000, are exported each year. Consequently there is little doubt that the elephants will soon be exterminated. Ivory is an important article of commerce, and is manufactured into stick-handles, billiard-balls, and all kinds of ornaments. The elephant is hunted in various ways. Some Africans attack the elephant single-handed, and are generally successful in despatching it. It is related of one elephant hunter that he went out armed only with a heavy spear and a short, double-edged sword. Crawling over the open ground, and concealing himself in the grass and behind bushes, he followed the elephant until he was close enough to touch it, when, with a rapid sweep of his sword, he severed the sinews of one of the animal's hind legs, and concealed himself again in the bush. The frightened beast, seeing no enemy, tried to make off quickly on its three sound legs, but the loss of blood and consequent exhaustion compelled it to lie down and rest. Taking advantage of this circumstance, the hunter sprang from his ambush and killed the elephant with a quick thrust of his spear.

The elephant can often be seen in zoological gardens and menageries, where its good-nature and its clever tricks make it a great favourite.

THE RHINOCEROS (*Rhinoceros*).—The Indian rhinoceros (*Rh. Indicus*) and the rhinoceros of Java have only one horn on the nose, while the African species has two. These awkward animals are enveloped in a wrinkled and bare hide, which may be compared to a coat-of-mail. They live either solitary or in small herds, in marsh and well-watered districts, and feed on grass, leaves, and roots. They only attack an enemy when provoked. “The earth trembles under their movements, and destruction follows in their footsteps.” Their horn is a terrible weapon. It is a bony excrescence, as sharp as a razor, and is used for ploughing up hard ground, or uprooting strong trees. When fighting with the elephant the rhinoceros attempts to rip up its enemy’s abdomen.

The HIPPOPOTAMUS (*Hippos amphibius*), Plate III., Fig. 7, is nearly as tall as the rhinoceros—viz., about five feet; but it exceeds twelve feet in length. The eyes and ears are small, its neck short and thick, and its feet clumsy. Its incisor teeth grow from twelve to eighteen inches long, and weigh from two to six pounds. This animal inhabits Southern Africa, where it is found in all lakes and rivers. Its principal food is grass, and it commits great ravages in the plantations. It is by nature peaceful, but when provoked gets into a violent rage. “It suddenly appears at the side of the traveller’s boat, into which it buries its teeth with a roar. One bite is sufficient to wreck the boat, and only a clever swimmer will escape the further attacks of the monster.” Some consider its flesh savoury. Its skin, when cut into strips, is manufactured into whips; its teeth are worked like ivory, and are especially used for the manufacture of artificial teeth.



Pig.

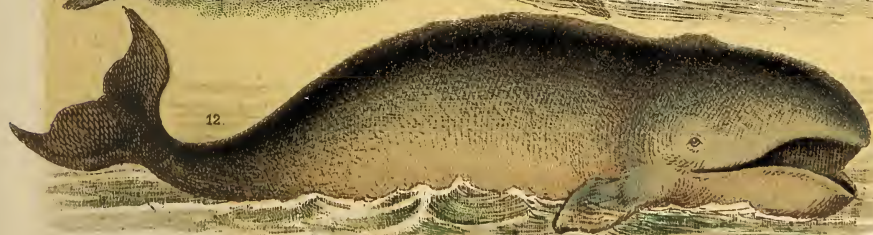
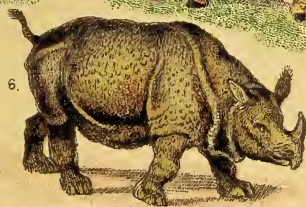
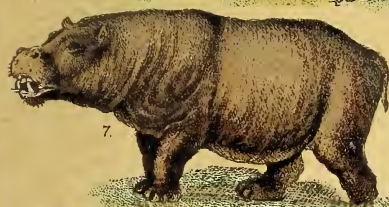
The WILD PIG (*Sus scrofa*) lives in herds in the well-watered forests of Central and Southern Europe, in Central and Western Asia, and in North Africa. The adult males are called boars, the females wild sows, and the young shoats. They feed on the fruits of forest trees, roots, etc., and do great damage in the fields by raking up the earth for long distances. For this reason and also for the sake of their flesh they are hunted.

The DOMESTIC PIG (*Sus scrofa domestica*) is descended from the wild pig. The domestic swine are met with everywhere, and there are many breeds. They attain an age of twenty years, but are generally slaughtered before they are two years old. The trichinosis, which causes dangerous diseases when introduced into the human stomach, lives on the flesh of many swine; raw pork should therefore not be eaten, unless it has been previously examined by an expert. The pig is despised for its uncleanness, but it provides a savoury food.

The AMERICAN TAPIR (*Tapirus Americanus*), Plate III., Fig. 8, inhabits South America. During the day it lies concealed in the recesses of the forests, but in the evening and early morning it frequents the marshes and rivers, where it wallows in the mud with its young. It feeds on the branches of trees, but also ravages the fields. It is a very shy and swift animal, and is hunted for its savoury flesh and fat.

DIVISION X.—THE SEALS.

In the seals the five toes of the limbs have become palmate, being joined together by a web; the hind feet



have a backward, horizontal direction. Their food consists of small marine animals and plants.

THE COMMON SEAL (*Phoca vitulina*), Plate III., Fig. 9, is spread over a large area, but is chiefly found in the northern seas. It is nearly six feet long, and its fur is yellowish grey, sprinkled above with dark-brown spots. It has no exterior ear. To the inhabitants of the north the seal is a most useful animal, its flesh and fat form their chief food, with its oil they illuminate the long winter nights, its sinews they use as thread, from its bones they make various domestic implements, and with its fur they cover their tents and sledges. Seals are gentle animals, and when tamed exhibit great attachment to man. When wounded they snap savagely in all directions. Seal-hunting forms one of the most important branches of commerce among seafaring nations. Over a thousand vessels leave America every year to take part in this seal-hunting; and as one vessel will sometimes capture nearly two thousand seals, some idea may be obtained of the immense number of these animals which are slain annually.

THE WALRUS (*Trichechus rosmarus*), Plate III., Fig. 10. —This animal is from eighteen to twenty-two feet long, and weighs from twenty to thirty hundredweights. It is easily recognised by the long tusks in its upper jaw, which attain a length of eighteen to twenty-four inches.

The walrus lives in the northern Polar seas, where it is sometimes met with in herds of one thousand to two thousand head. They either swim about in the water or lie basking in the sun upon ice-floes. When they are about to sleep one remains awake as sentinel. "These animals are harmless and quiet, but when attacked exhibit indomitable courage." They attract whole herds to their

assistance by their terrific roaring, which can be heard for several miles; in all directions their black heads, with red, dilated eyes, and gleaming tusks, emerge from the water. If a young animal is killed the mother gets into a frantic rage, and in such a case a single boat will only find safety in a rapid withdrawal. The walrus is hunted for its tusks, skin, and oil.

DIVISION XI.—THE WHALES, OR CETACEA.

In the cetacea the bodies are elongated, fish-like, devoid of hair, and run out into a powerful caudal fin. The fore limbs are in the form of fins; there are no hind limbs. The cetacea are marine animals, and their food consists wholly of water animals and plants.

The DOLPHIN (*Delphinus delphis*), Plate III., Fig. 11, is grey or greenish black on its upper parts, and white beneath. It generally attains a length of six feet, and lives in herds in all the northern seas. Hundreds of these swift animals are often seen around vessels, and amuse the passengers by their playful gambols. They feed chiefly on fish.

The GREENLAND OR NORTHERN WHALE (*Balæna mysticetus*), Plate III., Fig. 12, is greyish black on its upper parts, and white beneath. It is from forty-eight to seventy-two feet long, and weighs upwards of two thousand hundredweights. It is the largest of all living animals; a boat with six persons could enter its jaws. Its tongue is nine feet broad, eighteen feet long, and weighs about eight hundredweights.

The whale inhabits the northern parts of the Atlantic and Pacific. It has been hunted for the sake of its blubber since the ninth century. A whale forty-eight

feet long, and one thousand four hundred hundredweights in weight, will furnish six hundred hundredweights of blubber, from which four hundred and eighty hundredweights of train oil will be obtained; there will also be over thirty hundredweights of whalebone, which lies in the upper jaw in the place of teeth, in the form of three hundred to three hundred and sixty horny plates. A whale hunt is generally carried out as follows :—The whalers sailing for the high seas carry, as a rule, a crew of about fifty men, and a surgeon. One sailor is always stationed in the look-out, and signals as soon as he sees a whale spouting the water from its nostrils. The boats are then manned and lowered, each boat carrying a harpooner, whose business it is to harpoon the whale. The harpoons are barbed spears, fastened to about nine hundred to one thousand five hundred feet of rope. The harpooner stands in the bows, and as soon as one of the gigantic animals shows a part of its body he plunges in the harpoon. A red streak now dyes the water, and the whale rushes deep down into the sea, trying by all means to escape. The boat, however, follows, and when the animal comes to the surface to breathe it is again harpooned. The blood is now spouted upwards in streams, and the wounded monster at length turns over on its side exhausted. The vessel then approaches, and the dead whale is dragged on board. The blubber is soon cut out with large knives, and is either packed into barrels, or the oil is at once boiled out. The whalebone is also removed from the monster's jaws. The immense carcass is then thrown into the sea, where it is preyed upon by the shark, the hyæna of the ocean.

CLASS II.—THE BIRDS.

THE birds have a hard, bony skeleton, and red, warm blood ; they breathe by means of lungs, and lay eggs with hard shells. Their bodies are covered with feathers, their fore limbs are changed into wings.

DIVISION I.—THE BIRDS OF PREY.

The birds of prey have a hooked, curved beak, at the base of which are the nostrils, surrounded by cere skin. They live chiefly upon warm-blooded animals, which they seize with their claws and tear in pieces with their beak. There are more than five hundred varieties, which are separated into diurnal and nocturnal birds of prey.

(a) DIURNAL.

The CONDOR (*Sarcorhamphus condor*), Plate IV., Fig. 1, lives in the Andes Mountains of South America. It is the biggest of the birds of prey, and measures, when its wings are expanded, nearly ten feet from tip to tip. Its food consists of the flesh of dead mules, llamas, sheep, etc. It is gregarious, cowardly, and stupid, and does not attack man.

The BEARDED VULTURE or LAMMERGEIER (*Gypaetus barbatus*), Plate IV., Fig. 2, is the largest bird of prey of Europe. It was formerly often seen in the Alps and Pyrenees; but it is now, at least in the Swiss and Bavarian Alps, almost exterminated. It is a bold and dangerous robber, not only waylaying hares and roes, but also sheep and chamois; children have also frequently been attacked by this bird.

The OSPREY or FISHING HAWK (*Haliaetus albicilla*) is often mistaken for the golden eagle. The latter, however, can be easily recognised by its feathered legs. The osprey is found all over Europe. It has its nest on the

summits of inaccessible rocks and cliffs along the coasts, or in the top of a high tree, and rarely amongst the reeds. The osprey is a lazy but obstinate and dangerous robber, attacking all animals which it is able to overcome. Like the bald eagle, it catches fish; but it also feeds upon carrion.

The GOSHAWK (*Astur palumbarius*), Plate IV., Fig. 4, is found in almost all parts of Europe. It generally inhabits thick woods in the neighbourhood of fields and meadows, and builds its nest on the topmost boughs of a lofty tree.

This unsociable bird is as swift and wild as it is shy and cunning. It can be easily recognised at a distance by its long tail and short wings. When hunting for prey it flies, as a rule, along the edges of woods and thickets, and is active almost the whole of the day. Flying, resting, swimming, or running, it seizes its prey with equal dexterity. Its great swiftness and adroitness render the goshawk a formidable opponent. It appears suddenly among the unsuspecting birds, and, before they can escape, one lies bleeding under the claws of the bold robber. It follows its prey into inhabited houses, and sometimes flies through the windows.

The goshawk injures the farmer by carrying off his poultry, and it also steals game. And as it also destroys a great number of our most useful insect-devouring birds, it does not deserve to be spared.

The SPARROW HAWK (*Nisus communis*) resembles the goshawk both in form and habits, and is a true copy of its bigger cousin.

The JER-FALCON (*Falco gyrfalco*), Plate IV., Fig. 5, is either nearly white flecked with greyish brown, or dark on the upper parts and white underneath, and variously flecked. It inhabits the precipitous coasts of the northern

Polar districts, from whence young birds come as far south as Germany.



Falcon.

“The home of this splendid and noble bird is on the surf-beaten, precipitous cliffs of Iceland and Greenland, where the rising sun awakens the thousand-tongued chorus of the northern sea-birds. Suddenly the

confused sounds of the sea-birds are silenced, a hoarse ‘Kra-au! kra-au!’ is heard afar off, and the royal form of the powerful osprey appears, beating the air with mighty strokes of his wings, or sailing in undulating circles. All living things beneath him are his subjects; he has only to seize and take his meal. Still undecided, he circles over this large repast, when presently a clear ‘Giak-giak; Jak-jak!’ pierces the air, and from that distant cliff the jer-falcon shoots out upon him like a rocket. The mighty bird turns angrily towards his noble assailant; but before the movement is completed the falcon is already above him, and prepares to strike. Of course, it can do him no serious harm, but the osprey’s unwieldy might is of little avail against the wonderful dexterity of the smaller bird, so that, finally, in order to escape the disagreeable harassing attacks of his assailant, the osprey is obliged to fly off with quickened flaps of his wings. In sullen silence the mighty bird sails off, while with a triumphant ‘Giak-giak!’ the victor shoots off to his cliff proud of having attained his purpose.”

In the middle ages the jer-falcon was the bird chiefly trained as a hawk for hunting herons and pheasants.

(b) NOCTURNAL.

The WHITE or BARN OWL (*Strix flammea*), Plate IV., Fig. 6, is a bird familiarly known in England. It always lives in the neighbourhood of man, building its nest in sheds, church-towers, old castles, and ruins, and also in pigeon-houses. It sleeps during the day. At night it flies through the gardens and fields, catching all kinds of mice, insects, and also young birds. The nest is carelessly built, and in the spring contains from six to nine white, oval eggs.

The white owl is a very useful bird, as it often devours in a day from ten to fifteen mice. It is therefore scarcely conceivable that many farmers know no better than to reward this bird by nailing it on a barn door.

The BROWN OWL or TAWNY OWL (*Syrnium aluco*), Plate IV., Fig. 7, is a native of Central Europe, and is found in all parts of England where there are woods and mice. During the summer it remains in the depths of the wood; in winter it settles in the neighbourhood of towns and villages. It hunts chiefly in the early dawn and evening, and in dull weather even during the day. Its nest, which is generally placed in the hollow of a tree, contains already in March two or three white eggs. The brown owl is also a very useful bird.

Besides the white owl and brown owl there are many other nocturnal birds: the long-eared owl (*Otus vulgaris*), the short-eared owl (*Otus brachyotus*), the eagle owl (*Bubo maximus*), and the snowy owl (*Athene noctua*).

DIVISION II.—THE CLIMBING BIRDS.

The toes of the climbing birds are arranged opposite

to each other in pairs; one of the back toes is in many of these birds so flexible that it can be easily turned forwards. The claws are long, strong, and hooked, thus these birds can easily hold on firmly, even in a perpendicular position. Most of them frequent the woods, and live upon insects and fruit.

The GREY PARROT (*Psittacus erithaceus*), Plate IV., Fig. 8, is a gregarious bird, living in the wooded,



Grey Parrot.

mountainous districts of Central and West Africa. It is rather clumsy in flying, but a clever climber. Of all the parrots this bird is the best adapted for captivity; it learns with ease to whistle songs, to imitate the cries of animals, and to repeat phrases and sentences.

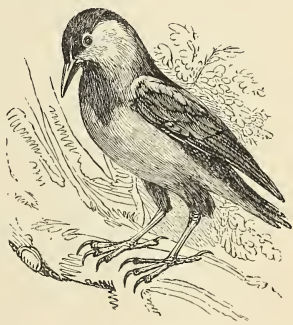
The parrots may be called the monkeys among the birds; for, like the monkeys, they seek their food while climbing, but are awkward and clumsy when on the ground. There are about four hundred varieties of parrots scattered over all the countries of the Torrid Zone; some varieties also occur in the Temperate Zones, but no parrots are found in Europe. Their imitative qualities and docility, their obstinacy and slyness, and their disagreeable voice and gregarious habits, all serve to remind one of the monkeys.

The TOUCAN or TOCO (*Rhamphastus toco*), Plate IV., Fig. 9, lives in the recesses of the aged forests of

Brazil. It belongs to the most curious of the animal forms, as its immense beak is treble the length of its head. Its food consists of small eggs, which it throws into the air and catches again in its open beak before swallowing. The Indians hunt the toucan both for its plumage and for food.

THE BLACK WOODPECKER (*Picus martius*), Plate IV., Fig. 10.—The plumage is black, the nape of the female is red, while the crown of the male is also red. It is a solitary bird, and attains to a length of twenty inches; it is found in mountainous districts, especially in pine woods.

The woodpeckers lead a solitary life. Their presence is generally known by the noise they make while pecking; holding fast to a tree, they hack at it with their long, sharp beaks, so that splinters and chips fly in all directions. The woodpecker excavates a hole in the rotten tree, in order therein to build its nest. It lives chiefly upon the insects which settle under the bark of sickly trees.



Woodpecker.

The nearest relations to the black woodpecker are the green woodpecker (*Picus viridis*), and the greater, medium, and lesser spotted woodpecker (*P. major, medius, and minor*).

The Cuckoo (*Caculus canorus*), Plate IV., Fig. 11, is as large as a pigeon. It occurs as a migratory bird almost all over Europe, Asia, and Africa. It visits us about the beginning of May, and leaves again in September. The cuckoo, with its never-wearied song, is the joyful harbinger of spring, and is heard with

delight by old and young. It is the only bird in the English woods which does not make a nest of its own, but lays its eggs in the nest of some small singing bird. The foster parents hatch the cuckoo's eggs, and then feed the greedy young interloper with such attention that their own offspring are often neglected and die. The latest observations have clearly shown that when the cuckoo finds no opportunity of laying its eggs in the nests of other birds, it hatches them itself. It lives chiefly upon hairy caterpillars; and, as it is always feeding, we can justly include the cuckoo among the useful birds.

DIVISION III.—THE SINGING BIRDS.

Not all the birds belonging to this class are veritable songsters; but nearly all of them have in the throat an organ of song, consisting of five or six pairs of muscles, by means of which they can produce a variety of notes. They are mostly small, prettily coloured birds, which chiefly inhabit the Temperate Zones, and make themselves very useful by devouring the insects, worms, and seeds of weeds in the fields, gardens, and woods. They delight us with their song; but their song is also the reason why many of them are kept in captivity.

The GREAT SHRIKE or BUTCHER BIRD (*Lanius excubitor*), Plate IV., Fig. 12, is a bloodthirsty bird which destroys mice, small birds, and large insects. It is a common bird in Europe, and frequently imitates the notes of other birds. It is generally seen perched high up in a tree, keeping a sharp look-out for prey. Its cousin, the red-backed shrike (*Lanius collurio*), is much smaller; it impales insects here and there on thorns, in order to preserve them for a later meal.



The WAGTAIL (*Montacilla alba*), Plate IV., Fig. 13, is a slim, prettily marked bird, and may also be considered as a messenger of spring, coming to England in March, and returning in October. Its flight is undulating and swift. This bird is chiefly seen in the fields and near watercourses, and is continually pecking with its beak and jerking its tail. It makes its nest in hollow trees, and in cracks in the walls of houses, also in ruins.

The GOLDEN ORIOLE (*Oriolus galbula*), or YELLOW THRUSH, Plate IV., Fig. 14, also called the GOLD THRUSH, inhabits Southern and Central Europe, but is an extremely rare visitant of this country. The males are (except in a few parts) of a bright yellow colour; the females and the young birds are greenish. The golden oriole lives chiefly upon caterpillars, but also devours ripe cherries with avidity.

The WHEATEAR (*Saxicola ænanthe*), Plate IV., Fig. 15, also called the FALLOW CHAT, resembles the wagtail, and builds its nest in rocky crevices, in the neighbourhood of quarries, or dry, sandy districts. It is a migratory bird, visiting us from April to September.

The WATER OUSEL or DIPPER (*Cinclus aquaticus*), Plate IV., Fig. 16, frequents the clear, mountainous streams, and is found all over Europe. It dives under the water, and wades over the pebbles with great rapidity. Its food consists of water insects and small fish, but it does not do much harm.

The NIGHTINGALE (*Luscinia philomela*), Plate IV., Fig. 17, visits England in April, and retires again in September. It builds its nest close to the ground, in a thick bush, generally in the neighbourhood of water. Its food, which it seeks for on the ground, consists

throughout the summer of the larvæ of insects and worms, and in the autumn of berries. The beautiful song of the nightingale is usually heard after sunset and at night. "It is the songster of the night. Deep from its breast it gives forth its harmonious melody, more prolonged and ever fuller and deeper swells its song, until it suddenly bursts forth into quavering trills, or dies off into melodious sighs, and then immediately swells up again and again into new melodies." The ancient Romans paid £45 for a nightingale, or more than they paid for a slave.

The BLACKCAP WARBLER (*Sylvia atricapilla*), Plate IV., Fig. 18, is met with, from the end of April to September, in all parts of England where there is dense bush or undergrowth. The head of the male is crowned with a tuft of black feathers; in the females and young birds this tuft is brown. The blackcap is also a celebrated song bird, and gives forth its beautiful melodies during the fall of rain, or immediately after rain. It generally builds its nest in a white-thorn bush.

The GOLDEN-CRESTED WREN (*Regulus cristatus*) is yellowish grey on the upper parts, while the under parts are greyish white, and the crown of the head a golden yellow. It is a small bird, being only four inches long. It lives throughout the summer in the woods, and in the winter it enters the orchards, and clears the fruit trees of all kinds of insects.

The HEDGE SPARROW (*Sylvia curruca*) is of a light grey on the back of the head, while the back is of a brownish grey; the sides have a reddish tinge, and the under parts are white. It is frequently met with in gardens, hedges, and bushes in Europe, from April to September.

THE COMMON WREN (*Troglodytes parvulus*) is, next to the golden-crested wren, the smallest of our birds, and is frequently met with in all parts of England. It generally lives on the rocky banks of brooks, and in quarries. It is continually hunting for insects, and searches for them in hollow trees, hedges, and piles of wood. Its trilling song is heard in the depths of winter, notwithstanding the cold and snow. The common wren builds its nest close to the ground; the nest is round, and closed at the top, there being a little hole in the side to permit of entrance and exit.



Wren.

THE ROBIN REDBREAST (*Erythacus rubecula*) is olive brown on the upper parts, wings, and tail, while the throat and front of the head are yellowish red, and the under parts white. It is frequently met with from March to October, and generally lives on the edges of woods. Some varieties winter in Southern Europe. The robin redbreast builds its nest on the ground; it hatches twice in the year, and feeds upon insects and worms. In some parts of Europe it is kept in the house, when it becomes very tame, and makes itself useful by catching the troublesome house-flies.

THE REDSTART (*Ruticilla tithys*) is bluish black on the head, neck, and breast; the back is ashen grey, the under parts light grey; the wings are brown, and the tail a reddish brown. This migratory bird also visits us from March to October, and lives chiefly in mountainous districts. It generally builds its nest in old buildings.

THE SONG THRUSH (*Turdus musicus*) is olive grey on the upper parts, while the under parts are a lighter grey,

with dark fleckings. It is a true inhabitant of the woods, and comes to us early in March, animating nature, then just waking, with its musical song. The song thrush lives upon insects, and also upon snails, which it strikes upon a stone in order to break their shells.

THE BLACKBIRD (*Turdus merula*).—The plumage of the male is quite black, and the beak yellow; the female is dark brown above, and greyish brown on the under parts, with a brown beak. The blackbird is also an inhabitant of the woods; but in the winter it comes into the gardens of the villages and towns. It is very fond of fruit, and thus often ravages the orchards and strawberry gardens.

Besides the thrushes already described, the following must also be mentioned: the missel-thrush, the wind-thrush, the fieldfare, and the ring-ousel. Most of these are trapped and shot as game.

The TITMOUSE (*Lophophanus cristatus*), Plate IV., Fig. 19, is continually met with in England, and lives chiefly in the woods. It feeds upon insects and all kinds of seeds; it is very lively, and flies and climbs with equal facility. It builds its nest in crevices.

The GREAT TITMOUSE (*Parus major*), the BLUE TITMOUSE (*P. coeruleus*), the FIR TITMOUSE (*P. ater*), and the FEN TITMOUSE (*P. palustris*) are frequently seen in all parts of Europe. They destroy a number of injurious insects, and are therefore extremely useful. They are very lively and quarrelsome; they live in small companies, and multiply rapidly.

The YELLOW-HAMMER (*Emberiza citrinella*) is reddish grey above, while the breast and under parts are yellow. It is met with everywhere, and in the winter comes into

the towns and villages, where in company with the sparrows it endeavours to satisfy its hunger by feeding on refuse of all kinds.

THE CROSSBILL (*Loxia curvirostra*), Plate IV., Fig. 20.—The old male has a bright-red plumage; the point of the lower part of the beak projects beyond the upper part. The crossbill lives chiefly in the pine plantations, where it feeds for the most part on the seeds of the pine, cleverly opening the cones with its pointed beak. It hatches in all seasons of the year.

The CHAFFINCH (*Fringilla coelebs*), Plate IV., Fig. 21, is well known as a visitor all over Europe, and is resident in England throughout the year. In the spring and summer it resides in the woods; but in winter and autumn it generally keeps along the brooks and rivers, for during this period it lives chiefly upon the seeds of the alder. It is frequently kept in a cage or aviary, but it is a quarrelsome bird, and lives on bad terms with its fellow-prisoners.

The GOLDFINCH (*Fringilla carduelis*), Plate IV., Fig. 22, is a bright-coloured, non-migrating bird, which is found in all parts of England. It makes its nest in the fruit trees, and delights us with its melodious song. During the hatching season it lives chiefly upon insects, with which it also feeds its young; in autumn and winter, however, it makes off to the hills and commons, as it is very fond of the thistle seeds. The goldfinch is, like the canary, highly prized as a domestic pet, and can also be trained to perform tricks.

The GREENFINCH (*Fringilla chloris*), Plate IV., Fig. 23, is often seen near the edges of woods, and in the hedges. Throughout the winter the greenfinches fly about in small companies, and feed upon all kinds of seeds.

Like the goldfinches, they are sometimes kept in captivity, but not so often as the former.

The COMMON SPARROW (*Passer domesticus*) is the "street arab" among the birds. "The sorry little simpleton in his grey coat" is known all over the world. It is a mischievous bird, takes possession of other birds' nests, fights with friends and foes alike, and is known everywhere as the same bold, obstreperous rascal. Theft is its daily occupation; ripening corn and sweet cherries are its favourite food; the blossoms of the finer kinds of pear trees it devours as a luxury. It is, therefore, not to be wondered at that it is nowhere a welcome visitor, and that even the service which it renders by the destruction of injurious caterpillars is no longer justly recognised. It has been introduced into America and Australia, in order that it might keep down the insect pests and clear the gardens of them. But instead of doing this the impudent sparrow



flits about the streets with its saucy chirp, and has rendered itself so obnoxious that the inhabitants would be glad if the impertinent little immigrant would withdraw again.

The annexed sketch shows us a fight between sparrows and starlings. During the absence of the latter,

Mr. Sparrow has taken up his quarters in the residence of the starlings, and has already carried in feathers and straw to build a nest. Of course it can be well understood that he is very unwilling to give up possession. But the starlings do not see the joke, and several well-directed digs with their beaks cause the bold chirper to fly off.

THE LARK (*Alauda arvensis*), Plate IV., Fig. 24.—This messenger of spring comes to us already in February and March, and retires in October. "Its melody rings out unweariedly in the stillness of the summer air." Who has not listened to the lark with delight, when darting up from the field it soars aloft in full song, ever mounting, ever singing, until high up in the clouds its circles of flight sparkle like golden rain in the rays of the sun? Its song is the sacred, joyful chant of innocence and peace, simple, sincere, childlike; and, rising up to heaven, it swells out with a glorious hallelujah. The lark is the daughter of light, and its song itself is the emblem of light. It rises out of the furrow with the first ray of the sun; and, when the sun is high in the heavens, its melodious song still rings out like a joyful farewell chant.

The following anecdote, which is told of Gustavus Adolphus, will show what confidence the lark has in man. He was riding round the Field of Nördlingen. Suddenly a lark, which was being chased by a sparrowhawk, flew to Gustavus for protection. He took the bird in his hand, saying: "Eh, dear little songster! God preserve thee. Dost thou seek refuge and protection from me? Well, these will I give thee as far as in my power." In the meantime the hawk had flown off, and the Swedish king then let the frightened lark fly.

THE WAXEN CHATTERER (*Ampelis garrula*), Plate IV.,

Fig. 25, is a native of Northern Europe. In some years these birds come south in large numbers, and remain from November to March. Their food consists chiefly of the fruit of the mountain ash.

The BIRD OF PARADISE (*Paradisea apoda*), Plate IV., Fig. 26, is adorned with orange-yellow tufts of feathers. It is a native of North Australia and New Guinea, where it lives in the recesses of the woods, and feeds upon insects and berries. The beautiful feathers, which, however, only occur on the male bird, are used as ornaments for ladies' hats.

The STARLING (*Sturnus vulgaris*) remains with us from the early spring until late in the autumn, passing the winter in North Africa. It is fond of living in the neighbourhood of man, and builds its nest in the hollows of trees, or sometimes in boxes specially placed for that purpose. It is easily tamed and taught to talk. "The starling plays his part of jester with never-failing success. Just when he appears to be most serious, he generally surprises us with the drollest of jokes. He imitates, in his own fashion, the cries of the cat and the hen, the barking of a dog, the croaking of a frog, or the creaking of a waggon-wheel, etc."

The JAY (*Garrulus glandarius*), Plate IV., Fig. 27, is a constant inhabitant of our woods, and imitates the notes of other birds with ease. It collects large stores of acorns, beech-nuts, and hazel-nuts, which it conceals; but the squirrel often steals them. The jay does not deserve to be spared, for it is even more destructive to the young of the insect-devouring birds than the shrike. Closely related to the jay is the magpie (*Picea caudata*).

The ROOK (*Corvus frugilegus*) is a familiar bird, which generally builds its nest in the neighbourhood of fields

and meadows, and makes itself useful by the destruction of numerous insects. The rook and its dark brothers (the ravens, crows, and hooded crows) are vulgarly called ravens. The saying, "He thieves like a raven," betrays a not very laudable characteristic of these birds.

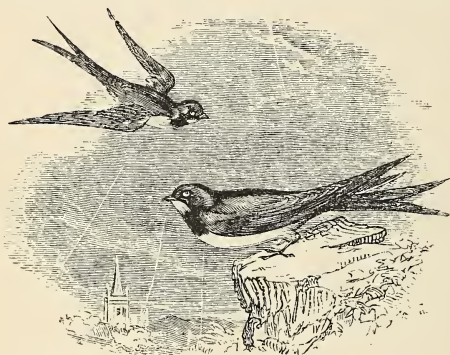
The COMMON TREE-CREEPER (*Certhia familiaris*), Plate IV., Fig. 28, is, like the following bird, a kind of woodpecker, as it cleverly climbs up the trees, balancing itself with its tail erect. It is found in all parts of England, and is met with during the winter over a considerable area of Europe. It is a very useful bird, as it generally builds its nest in orchards where it destroys numerous insects.

The NUTHATCH (*Sitta Europæa*), Plate IV., Fig. 29, is greyish blue on the upper parts, while the under parts are of a buff orange or white. It generally frequents the woods, and resembles the tree-creeper in habits and use. It not only climbs upwards, but runs with equal agility head downwards along the branches. It usually builds in the hollows of trees, narrowing the entrance to its nest with mud.

The COMMON HOOPOE (*Upupa epops*) is easily recognised by its high crest. It is a migratory bird, arriving in England in the middle of April, and retiring again in September. It generally frequents the edges of woods and small plantations, especially in the neighbourhood of meadows. It feeds upon insects and worms. The latter it throws into the air, and catches them with its open beak. "When the hoopoe emits its well-known cry of 'Hup, hup, hup!' it spreads out its crest in the form of a fan. It builds its nest sometimes in rocky crevices, sometimes in holes in the earth, but mostly in hollow trees, especially the willow. Its fear and timidity are in accord with its solitary habits. It trembles at every

sound, and even at the noises made by other birds. When it imagines itself in danger it throws itself on the ground, to deceive its enemy, and makes itself unrecognisable by spreading out its wings, and bending its head with the beak directed upwards."

The SWALLOW (*Hirundo rustica*), Plate V., Fig. 2, is one of the most agile of the birds of flight, and a familiar



Swallow.

spring visitor, arriving early in April, and leaving us again in October. It hatches twice in the year, and generally builds its nest in the interior of buildings, stables, sheds, etc. Its food

consists of insects, which it catches on the wing.

The HOUSE MARTIN or MARTLET (*Chelidon urbica*) builds its nest on the outside of buildings. It is a familiar and highly esteemed bird. "In popular tradition it is believed to ward off danger and trouble. This tradition is no doubt supported by the elegant appearance of the bird, and by the rapidity and grace of its flight in the air, also by its tenderness towards its young, the joyful cry with which it accompanies its flight, and the affectionate, almost touching, twittering with which it accompanies the work of hatching."

The COMMON NIGHT-JAR or GOATSUCKER (*Caprimulgus Europæus*) is considerably larger than the martin. It is not unfamiliar on the borders of woods and heaths. During the day it sits sleeping on the ground or in the top of a tree, where it is not easily seen, on account of

the sober colours of its plumage. It lives upon insects chiefly those which fly by night.

DIVISION IV.—THE COLUMBIDÆ.

The beaks of these birds are straight, only being slightly curved at the point. Their long, pointed wings enable them to maintain a rapid and continued flight. They build rough nests in trees or on the ground, and feed upon grain of all kinds. Their flesh is eaten.

The RING DOVE or CUSHAT DOVE (*Palumbus torquatus*), Plate V., Fig. 3, is a true inhabitant of the woods, and the largest of the pigeons. It is a wild, shy bird, and is consequently not often seen. Its food consists of the seeds of the pine, beech-nuts, and acorns, which it picks up from the ground.

Related to the ring dove are the stock dove (*Columba oenas*), and the rock pigeon (*Columba livia*), the progenitor of the domestic pigeon, from which an immense number of varieties have been produced by crossing the breeds. The most important of the domestic pigeons are the common domestic pigeon, the trumpeter, the ruff pigeon, the Jacobin, the Turkish pigeon, the carrier pigeon, which, on account of its great power of remembering localities, is used for carrying messages; the pouter, the tumbler, the turbit, the fantail, and the oriental pigeon. They are kept in pigeon-houses, and fed with seeds of all kinds. The young pigeons are highly esteemed for their delicate flavour. There is a brisk trade in pigeons, and those of good breeds are much sought after, and fetch a somewhat high price.

The TURTLE DOVE (*Turtur auritus*) is frequently kept in captivity, as it is the smallest and prettiest of all the Columbidae.

THE COMMON DOVE (*Turtur risorius*) is also kept caged. It is of a greyish-white colour, with a black band across the neck. Its lively "Ku-ku-ruuh" is often alternated by a playful "Hi-hi-hit."

DIVISION V.—THE GALLINACEOUS BIRDS.

The beak is nearly always shorter than the head, and has projecting edges; the wings are generally short, and rounded off; the legs are furnished with callosities. All these birds build their nests on the ground, and their young are nest fledglings, leaving the nest on the same day.

THE CAPERCAILZIE (*Tetrao urogallus*), Plate V., Fig. 4.—The cock bird is about thirty-nine inches long, and weighs from ten to twelve pounds; the hen is about one-third smaller. This solitary and extremely shy bird inhabits the mountain woods of Europe and Asia. The cock feeds upon the pine needles, young shoots, and seedlings; the hen and the young birds also feed upon insects and worms. The capercailzie is much sought after for its excellent flesh.

Related to the capercailzie are the black grouse (*Tetrao tetrix*), heath grouse (*Bonasa silvestris*), and the ptarmigan (*Lagopus mutus*), all of which are highly valued for their delicate flavour.

THE PARTRIDGE (*Perdix cinerea*) is found in all corn-growing districts. It is a shy bird, and runs swiftly; its flight is sharp and whirring. The upper parts of the partridge are light brown, flecked with darker and lighter markings; the throat is a reddish brown, the breast grey, the under parts white with a chestnut-brown patch, and the tail reddish brown. It feeds upon insects, worms, corn, and the young, soft shoots. Its flesh has a delicate flavour.



The QUAIL (*Coturnix communis*), Plate V., Fig. 5, is the only migratory bird among the game birds. The flight of the quail is protracted; but, when on their wanderings over Southern Europe, they are shot, snared, and netted in thousands. They live generally in the corn-fields, and feed in the same manner as the partridge. The young leave the nest as soon as they are hatched, and the hen bird feeds them with the pupæ of ants, young worms, etc. The quail is kept as a domestic pet in some parts of Europe on account of its agreeable note.

The ARGUS PHEASANT (*Argus giganteus*), Plate V., Fig. 6, is frequently kept in gardens and pheasant preserves. It originally inhabited Southern China, but has long been introduced into European countries. The common pheasant (*Phasianus colchicus*) is much more common in England, and is carefully reared in preserves on account of the delicacy of its flesh. A beautiful bird is the gold pheasant (*Ph. Pictus*); its plumage is all scarlet and gold.



Fowls.

The DOMESTIC FOWL (*Gallus domesticus*) is apparently descended from the Bankiva jungle fowl, which lives wild in Southern Asia. It is reared in all parts of the world on account of the large number of eggs it lays

and the delicacy of its flesh, and is distinguished into numerous breeds and varieties differing in size, colour, and plumage. The most important of these are the common fowl; the Cochín China, with feathered feet (the latter is remarkable for its size, the assiduity with which it lays its eggs, and the readiness with which it takes any kind of food); the Dorking fowl; the Brahmaputra; the Crève-cœur fowl; the Houdan fowl; the Spanish, Italian, Indian, and Dutch fowls; and the Bantam fowl.

THE PEACOCK (*Pavo cristatus*).—The male peacock has brilliant upper tail coverts, which are coloured with



Peacock.

a refulgent golden hue, and adorned at the end with a greenish-blue patch in the form of an eye. The hen bird, on the other hand, is of a general brown on the upper parts, while the under parts are white.

The peacock, which lives wild in the forests in the East Indies and Ceylon, is said to have been first brought to Europe by Alexander the Great, and it is now often seen in gardens and on lawns. "It

is a remarkable fact that, at least on the island of Java,

the peacock is nearly always found in the company of the tiger. When its rarely heard screech pierces the evening air from the depths of the jungle, it announces the hour at which the tiger leaves his lair. Then the traveller carefully fastens up his bamboo hut, and the Javanese retires within his stockade, for the tyrant of the jungle is stealthily prowling around."

The voice of the peacock resembles "Páo." Its flesh is tough; the splendid feathers of its tail, which it can elevate in the form of a wheel, are used for all sorts of ornamental purposes.

We may briefly mention here the GUINEA FOWL (*Numida meleagris*), a native of Africa; and the WILD TURKEY (*Meleagris gallopavo*), a native of North America. This bird is probably the original stock of the foolish and quarrelsome Domestic Turkey, which is reared in England for its delicate flesh. When the latter happens to touch a cart-wheel with its wide tail feathers, it gravely stalks off with its head thrown back and wings outstretched, giving vent to loud gobbling cries.

DIVISION VI.—THE CURSORES.

The neck is long; the wings are stunted, and useless for flying; the tail feathers are wanting; and the legs are extraordinarily powerful.

The AFRICAN OSTRICH (*Struthio camelus*), Plate V., Fig. 7, is the biggest of all birds, and is a gregarious bird, living in flocks in the deserts of Africa. It is uncommonly timid, and takes fright at animals which are harmless. Its food consists of grass, leaves, insects, etc.; but it also swallows stones, bits of wood, and other hard objects. The large eggs (one weighs about three

pounds, and is equal to twenty-four breakfast 'eggs) are laid in a hole in the ground, and during the day are hatched by the heat of the sun, or alternately by the



Ostriches.

male and female bird; but at night the male only sits upon them. The speed of the ostrich is very great. "What a sight when the ostrich, put to flight, spreads out its wings, jerks out its powerful legs to the right and left, and careers over the sandy plain! Its speed continually increases, its feet at last seem to scarcely touch the ground, its steps become leaps, six, nine, twelve

feet long; and in the space of barely a minute it has covered perhaps a distance equal to an English mile. And it is only when the arrow-like swiftness of the fleeting, giant-like bird is seen that the quotation from Hiob is understood: 'When the ostrich is in full flight it laughs at both horse and rider.' It is certain that the best Arabian steed could not keep up with the ostrich for long."

Writing of an ostrich hunt, Masius says: "The ostrich hunter mounts his horse, clad in a thin burnoose, and without firearms, armed only with a tamarind stick and a hunting knife, and, in order to carry as little weight as possible, instead of a bridle and bit he guides his horse with a piece of cord. After hanging to his saddle the small bottle of water with which to moisten the mouth of his steed from time to time, and then seeing that the camels are ready which are to carry the great skins filled with water, the provisions, and the horseshoes and nails

for the hunt, a start is made. The Arabs know that the ostrich, trusting more to swiftness than to stratagem, will run on continually in a straight line. And they make their plans accordingly. About five riders place themselves at distances of about a mile apart along the course which the ostrich will probably take. As soon as the first hunter has followed the bird for a mile, the second takes up the hunt with his fresh horse ; then the third follows on, and after him the fourth ; and in this way the hunters run down the panting, exhausted bird. A sure, well-directed blow with the tamarind stick smashes its head, which has no protecting feathers. The bird falls, dying with a cry of agony ; the female bird sinks without a cry."

The feathers of the ostrich are used for adornment, and are expensive ; the eggs and the tough flesh are eaten ; the shell of the egg is used as a water vessel.

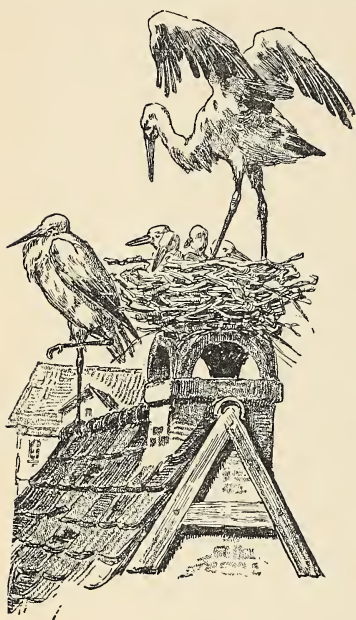
DIVISION VII.—THE WADING BIRDS, OR STRUTHIONES.

The beak is generally slender, the legs long and stilt-like. The struthiones live in marshy spots, and on the banks of rivers. They feed upon the reptiles and insects found in water and marshy districts, and upon plants. Most of the struthiones are migratory birds.

The CRANE (*Grus cinerca*) is the largest European bird. It is seldom seen in England, and avoids the neighbourhood of man. It lives in marshy districts, where there is a supply of reptiles, insects, and tender shoots.

The STORK (*Ciconia alba*) is found in nearly all parts of Europe, and is a familiar and esteemed bird. It seeks out the marshy and well-watered districts, and lives upon frogs, snakes, mice, insects, and young birds.

It generally makes its nest on the top of high buildings. Although it attacks the weaker members of its own race, and seizes the young of its neighbours, yet the



Storks.

stork can lay claim to many noble qualities. Such are its confidence, its cleanliness, its love for its young, and its sociability ; whole families of storks often unite in gatherings and for war. How joyfully it claps its beak ! What a solemnity lies in its movements, whether walking or standing ! How majestic is its flight ! It was formerly, and is still in some parts, regarded as the bringer of luck and the protector against misfortune. " Where it builds, no lightning flashes ; the seeds spring up. And in the middle

ages the death of a stork was considered as equal to the death of a man."

The HERON (*Ardea cinerea*) grows to the size of a stork. It has a long beak and a tuft of black feathers at the back of the head ; it is a greyish blue on the upper parts. This bird is found wherever there are lakes and rivers. It is a patient, clever, and artful fisher ; but in the absence of its favourite food, the fish, it feeds upon frogs, snails, mice, and young birds. It builds its nest in trees.

The GREAT BUSTARD (*Otis tarda*), Plate V., Fig. 8, inhabits Southern and Central Europe, but is now rarely

met with in England. It is injurious to agriculture, as it roams through the fields picking out the seeds and eating the young shoots of vegetables, at the same time scratching the ground for worms and insects. It is a very sharp bird, and is so swift on foot that it reminds one of the ostrich, so that it is a very difficult bird to catch. It grows to a height of thirty-five inches, and attains to a weight of from twenty-five to thirty pounds.

The DEMOISELLE or NUMIDIAN CRANE (*Grus virgo*), Plate V., Fig. 9, is not so large as the crane; it is graceful in form, and frequently indulges in waltz-like movements.

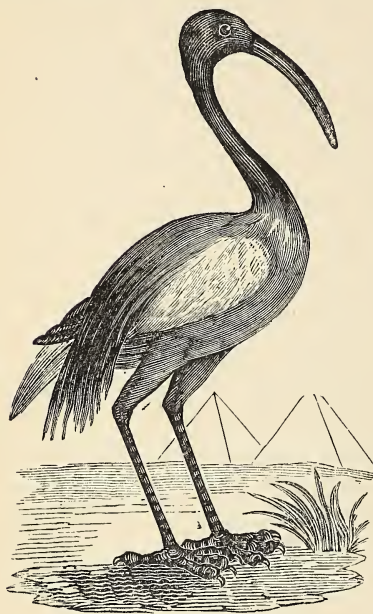
The COMMON COOT or BALD COOT (*Fulica atra*), Plate V., Fig. 10, is a familiar bird in England from March to October. It lives almost continually on the water of lakes and ponds, and feeds upon water insects and weeds. Its nest is built in the reeds.

The WOODCOCK (*Scolopax rusticola*), Plate V., Fig. 14, is a migratory bird; it arrives here in autumn, and some few remain with us during the summer. It builds its nest in the thick bushes. At the approach of danger it carries its young to a place of safety. It bores holes in the marshy ground with its long beak, in order to get at the worms, larvæ, etc. It is much esteemed for the delicacy of its flesh.



Woodcock.

The SACRED IBIS (*Ibis religiosa*), Plate V., Fig. 17, is a native of Africa. It builds its nest in trees. The



Ibis.

ancient Egyptians worshipped it as the emblem of purity, and used to embalm it.

The GREEN PLOVER (*Charadrius plumialis*), Plate V., Fig. 11, is found all over Europe, and lives near marshes and fields. It passes the breeding season in the north of Europe, but retires in the winter to North Africa. It pipes loudly during rainy weather.

The OYSTER CATCHER (*Hæmatopus ostralegus*), Plate V., Fig. 12, inhabits the coasts of the North

Sea in the summer, and retires to Southern Europe in August.

The LAPWING (*Vanellus cristatus*), Plate V., Fig. 13, is found in England from March to September. It builds its nest in marshy places, but is frequently robbed of its eggs, as they are much esteemed for their fine flavour.

The BITTERN (*Botaurus stellaris*), Plate V., Fig. 15, arrives in March and retires again in October. It lives near ponds and lakes which are well grown with reeds. In the evening the cry of the male bird, "Wrumb," can be heard for some distance, and has caused it to be called the "marsh cow." The bittern feeds upon small fish, and does much damage in waters where fish are bred.

THE ADJUTANT BIRD (*Ciconia Marabu*), Plate V., Fig. 16, inhabits the towns of the East Indies, and, in company with the carrion crow, feeds on putrefied refuse. It is considered a sacred bird. The beautiful tail coverts are in great request for purposes of adornment.

DIVISION VIII.—THE SWIMMING BIRDS, OR NATATORES.

The beak is of a medium length ; the front toes are, as a rule, joined together by a membrane, to aid the birds in swimming. The natatores live upon all still and flowing bodies of water, and feed upon the water reptiles and insects, rarely upon the water plants ; and they are esteemed for their flesh, eggs, and feathers.

THE FLAMINGO (*Phœnicopterus ruber*), Plate V., Fig. 18, is a solitary bird, living in Africa, on the shores of the Mediterranean. It feeds upon water reptiles and insects. Its flesh is eaten. It lays its eggs on a conical-shaped prominence, and hatches them by sitting astride on the nest.

THE PELICAN (*Pelecanus onccrotalus*), Plate V., Fig. 19, is a native of South-east Europe, Asia, and Africa. It is the largest of all swimming birds, and is found in hundreds on the lakes and rivers of the countries mentioned above. Under its beak hangs down the long pouch—"the larder of this ever-hungry eater." Notwithstanding the clumsiness of this bird, it is a remarkable flyer, traversing the Mediterranean in one continued flight. It feeds upon fish, and can be easily tamed. Its flesh is eaten.

THE COMMON TERN OR SEA SWALLOW (*Sterna hirundo*), Plate V., Fig. 20, is met with on all the coasts of Europe.

Its wings are extraordinarily long, and its tail is forked. Its flight is rapid. They take great delight in flying, soaring in large flocks and crossing and recrossing each other in the air.

The LAUGHING GULL (*Larus ridibundus*), Plate V., Fig. 21, is found on the coasts of Western and Southern Europe, but it also visits the rivers and lakes inland. Besides fish, it feeds upon worms and insects.

The ALBATROSS (*Diomedea exulans*), Plate V., Fig. 22, builds its nest on the solitary islands of the Atlantic and Pacific Oceans, but is also frequently found at the Cape. These birds often sit in very large flocks along the coasts, and at a distance look like a flock of sheep; this habit has caused the albatross to be called also the Cape sheep. It is a clever swimmer, and a still cleverer flyer; even in the most violent storm it scarcely moves its wings when in flight.

The CRESTED GREBE (*Podiceps cristatus*), Plate V., Fig. 23, belongs to the last family of birds—the divers. It is a bad flyer, but a clever diver. It builds its floating nest on the surface of the water, and feeds upon small fish, crabs, water insects and seeds. It is found in the fenny midland districts of England, and also in Scotland.

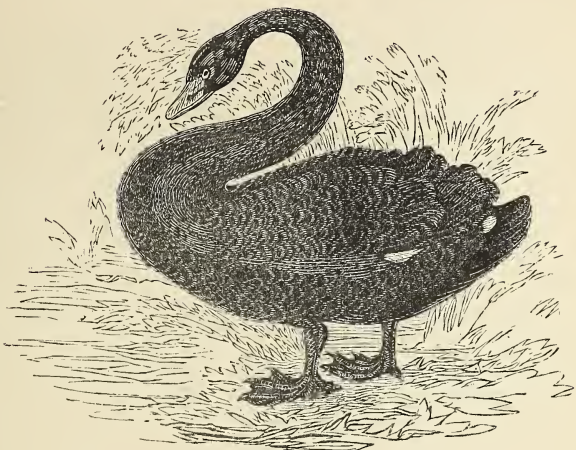
The MUTE SWAN (*Cygnus olor*) is often kept as an ornamental bird upon lakes and ponds, where, swimming amongst the ducks, it attracts attention by its snow-white plumage, and more especially by its stately movements. The smaller black swan, shown on the next page is also often seen. The swan is a native of the cold regions of the Old World, and only breeds in a few places in England. In the far north of the Old World a more common bird is the song swan (*Cygnus musicus*), which is hunted by the Icelanders for its feathers. It

is a migratory bird, and crosses over Europe in April and May, and again in October.

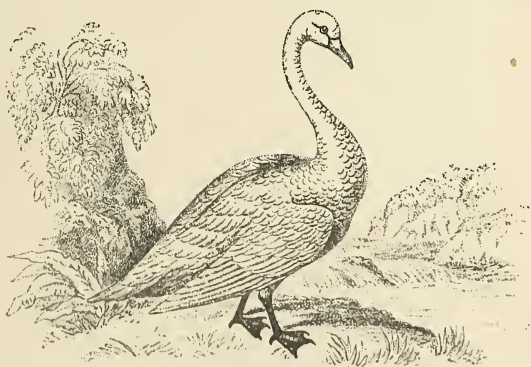
To this class also belong the geese and ducks. The wild goose (*Anser ferus*), the original stock of our well-known domestic goose; the stubble goose (*Anser segetum*),

which frequently visits us in winter, coming from the far north, and damages the farmer by feeding on the young seeds. The wild duck or mallard (*Anas boschas*), the progenitor of our domestic duck, visits us in large flocks, and frequently hatches its young in this country. Ducks and geese

are reared both for their feathers as well as for their delicate flesh and eggs. The stupidity of the goose is proverbial; but this reproach is just as ill-founded as is



Black Swan.



SWAN (Wild.)

the case with the donkey. It is well known that the watchfulness of the geese once saved the Capitol at Rome.

Many aquatic birds accumulate large layers of excrement, remains of fish, etc., near their nesting-places during the year, and these accumulations are collected and sold under the name of "Guano," forming a fine manure.

CLASS III.—THE REPTILES.

THE reptiles are vertebrates which are furnished with a horny or bony skin; they have red, cold blood, breathe by means of lungs, and generally lay eggs; many of them have no feet. Some reptiles pass the winter in sleep.

DIVISION I.—THE TORTOISES.

They have a wide body, which is enclosed between the arched shell of the back and the flat shell of the stomach; teeth are wanting. There are land, sea, and river tortoises.

THE EUROPEAN MUD TORTOISE (*Emys lutaria*), Plate VI., Fig. 1, is frequently seen in Italy and the south of France. It inhabits lakes and slow-flowing waters, and feeds upon small fish, spawn, frogs, water insects, etc. It lays its eggs in a hole, which it digs in the bank. Its flesh is edible. Small specimens are frequently kept in aquariums, and fed with meat, bread, lettuce leaves, etc.

The giant turtle is well known; it attains to a length of six feet, and a height of three feet, weighing from eight to ten hundredweights. The caret turtle is also familiar, and furnishes a shell, which is made up into combs, snuff boxes, etc.

DIVISION II.—THE CROCODILES AND ALLIGATORS.

They have a scaly, tough skin on the back, four powerful feet, and a long tail. They live chiefly in the water, and only go to the banks to bask in the sun.

The ALLIGATOR (*Alligator mississippiensis*), Plate VI., Fig. 2, is found in the southern states of North America. It is as voracious as it is bloodthirsty. No bullet will pierce the hide on its back. It deposits its eggs in a kind of nest, which it builds with grass and mud on the banks, and defends with great fierceness. It deposits about one hundred eggs in this nest. The alligator is captured in various ways, but there is some danger in hunting it.

A near relation to the alligator is the Egyptian crocodile, which is from twenty-six to twenty-nine feet long, and more dangerous than the former, since it attacks man without provocation; it is chiefly found in East and Central Africa.

DIVISION III.—THE LIZARDS.

The elongated body of the lizards is covered with scales or plates, and they have either four, two, or no feet, and live upon land. Their food consists of insects, worms, etc.

The SAND LIZARD (*Lacerta agilis*), Plate VI., Fig. 3, is generally found in holes in the ground and cracks in walls, and is common nearly all over Central Europe. In June it lays from five to eight whitish eggs in ant-hills or under the moss, and the young lizards escape from the eggs in August. The lizards are quite harmless, and deserve to be spared, both on account of their liveliness and

usefulness. They are frequently kept in aquariums, and fed with flies and other insects.

The BLINDWORM (*Anguis fragilis*), Plate VI., Fig. 4, is a peaceable little reptile, which only devours slugs, and, contrary to popular notions, is never injurious to man. Many people are afraid of the blindworm, mistaking it for a serpent. But its skeleton alone clearly shows traces of rudimentary limbs; and it has also eyelids, which serpents never have. The blindworm frequently basks in the sun on commons and highways, and its rustle among the dry leaves often startles nervous individuals. Blindworms can be easily kept in a terrarium.

The FLYING DRAGON (*Draco volans*), Plate VI., Fig. 5, is found on trees in the island of Java. It generally frequents the trees along the banks of great rivers, in the leaves of which are numerous insects, upon which the flying dragon feeds. As it is as green as the leaves of the trees, it can only be recognised by an experienced eye. The Indians hunt it for its delicate flesh, and also seek for the eggs, which are found deposited, often fifteen to twenty at a time, in a hollow in the ground.

The IGUANA (*Iguana tuberculata*), Plate VI., Fig. 6, is found in the East Indies and in South America. It lives in trees along the banks of rivers, feeding upon the insects. Its usual colour is dark olive green. Its flesh is considered a delicacy, being tender and very much like that of a chicken. The eggs, of which the female deposits from four to six dozen at a time, are also eaten.

The GECKO (*Platydictylus guttatus*), Plate VI., Fig. 7, is a native of the East Indies and China. At dawn these reptiles creep out of their holes, and with dilated eyes look around for prey. As soon as they catch sight of it,



the clumsy creatures spring upon it from a distance of four to six inches, with all the violence and rapidity of an animal of prey. Sucking pads on the feet of the gecko enable it to cling firmly to the most slippery surface, and to crawl about it without slipping ; its claws, which are sharp and retractile, are also useful to this reptile.

The CHAMELEON (*Chamæleo vulgaris*), Plate VI., Fig. 8, is a very peculiar creature. It is a native of North America, and has hitherto not been found in any part of Europe with the exception of Andalusia. The formation of its toes and its curled tail enable it to climb up trees with safety. Here it remains, and often sits motionless for hours ; but suddenly darts out its long, worm-like tongue towards an insect which has ventured to approach too near. As its tongue is very sticky, it never fails to secure its prey. It is especially remarkable that this reptile can change its colour at will ; it is black in anger, green when pleased, and white or spotted when alarmed ; it is green in the morning, dark at mid-day, and a dull white after sunset.

DIVISION IV.—THE SERPENTS.

The serpents have elongated bodies, covered with plates or scales, and no feet. Many kinds have no poisonous fangs in the upper jaw. Serpents reproduce their species from eggs, and feed upon living animals ; those found in colder regions sleep through the winter.

The RATTLE SNAKE (*Crotalus durissus*), Plate VI., Fig. 9, has a rattle at the end of its tail, consisting of twelve to eighteen horny rings, lying one in the other. It is one of the most dangerous and most dreaded reptiles ; it is from four to seven feet long, and very

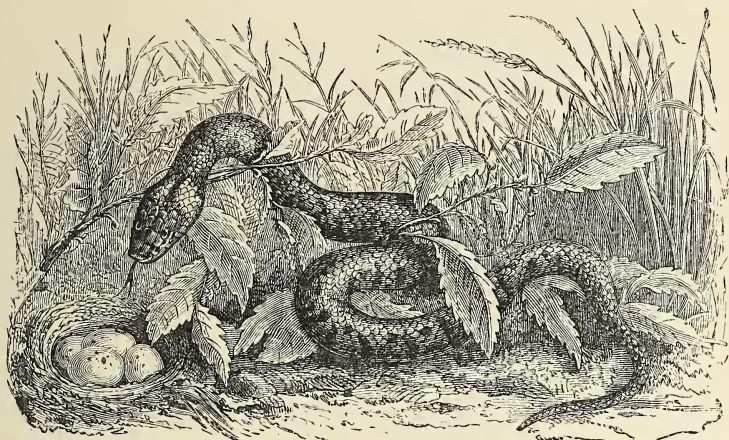
poisonous. The young serpent creeps out from the egg a few minutes after it has been laid.

The VIPER or ADDER (*Pelias berus*), Plate VI., Fig. 10, is the only poisonous reptile inhabiting England. It is generally found on heaths and moors, and in stone quarries and woods. During the day it remains in the neighbourhood of its haunt, but at night it wanders forth in search of prey. Its food chiefly consists of mice. The bite of the viper is very dangerous, death sometimes ensuing within an hour. When a person is bitten, prompt measures must be taken to prevent the poison getting into the blood. The wound should be firmly compressed with a stone, or the flesh should be cut so as to make it bleed freely. In all cases a surgeon should be sent for as soon as possible.

The BOA-CONSTRICTOR (*Boa constrictor*), Plate VI., Fig. 11, inhabits the forests and wooded districts of South America. It attains a length of from ten to seventeen feet, and feeds upon animals of various sizes. It envelops large animals within the contracting folds of its body, and thus crushes them to death, whereupon it slowly swallows its prey. It seldom attacks man. The skin of the boa-constrictor is tanned and used for making boots, etc.

The RINGED SNAKE or GRASS SNAKE (*Tropidonotus natrix*), Plate VI., Fig. 12, is found in all parts of Europe except the north. It generally has its haunt in the neighbourhood of water, and swims and dives well; its food chiefly consists of frogs and toads. This harmless reptile is easily recognised by the two yellowish-white patches behind the head, which have given rise to the tradition of the golden crown said to be worn by the grass snakes. These snakes lay their eggs, twenty to

thirty, joined like a string of pearls, in dung-heaps and in damp moss. The green snakes are perfectly harmless,



Ringed or Grass Snake.

and it is surprising that so many people know no better than to kill them without the least hesitation.

As the lizards, blindworms, and green snakes are frequently kept in terrariums, we will give here a few hints on the

Arrangement and Management of a Terrarium.

The bottom of the terrarium is covered with zinc, over which a layer of sand is spread, moss being placed in parts. In the middle a small rockery is built up of several tufa stones, and in front of the latter in a hollow in the sand there should be a water reservoir five to seven inches wide, with a knotty branch of a tree at each end for the reptiles to climb upon.

Wherever possible the terrarium should be placed in a window facing the south, so that the reptiles may have as much sunshine as possible. The lizards and blindworms should be fed upon flies, slugs, snails, etc. ; toads

and frogs should be given to the green snakes; and lizards and blindworms to the adder. Little trouble is required to keep the terrarium in order. The water, however, must be changed frequently and the bottom cleaned; it is also advisable to put in fresh moss now and again.

Before the advent of winter the reptiles should be taken out of the terrarium, and placed in a box half filled with earth, then cover them with moss, and put the box in a place where it will be free from frost, or put it in a hole about eighteen inches under the earth. But as soon as the spring is warm enough, set up the terrarium again, and put in the reptiles, which will then have wakened out of their long winter sleep.

CLASS IV.—THE AMPHIBIA.

THE amphibia hold a middle position between the reptiles and fishes. The larvæ, after leaving the eggs, live in the water like fishes; they gradually accustom themselves to live in the air, and when their metamorphosis is complete they breathe by means of lungs. The name amphibia, or double livers (that is, both in water and on land), is therefore very appropriate for these reptiles. They have red, cold blood, and are enveloped in a smooth, often slippery, skin.

DIVISION I.—THE FROGS.

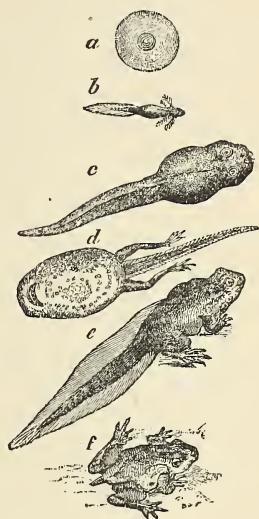
Frogs when fully developed have a short, tailless body, a large head, and four legs, the toes being frequently joined together by a membrane.

They deposit their eggs (*a*) in the water, either in

masses or in strings. The larvæ (called tadpoles) have a long, flattened tail (*c*); they have no legs, and breathe through gills (*b*), and are therefore very different from the fully developed frog. The gills gradually disappear, and lungs are developed; the fore legs make their appearance, the hind pair developing first (*d* and *e*); the tail gradually diminishes, and finally disappears (*f*). The metamorphosis, or change, is then complete, and the young frog leaves the water to begin its life upon land.

The EDIBLE or GREEN FROG (*Rana esculenta*), Plate VI., Fig. 13, is common in all the warmer parts of the Continent. It is a large frog, and inhabits the ponds and lakes. After sleeping, buried in the mud throughout the winter, it leaves its winter quarters in April, and at night the loud croaking of the males, "Quack, quack, quack—geek, geek, geek!" can be heard for hours at a time. The female lays about a thousand eggs. The larvæ change their condition in October; but the frog is not fully developed until it is five years old. The great enemies of the green frog are the storks and grass snakes.

The COMMON FROG (*Rana temporaria*), Plate VI., Fig. 14, is familiar all over Europe, and is found in the early spring in all our ponds, ditches, and lakes, in which also large quantities of frogs' eggs can be seen. The common frog leaves the water immediately after spawning, and makes itself very useful by destroying numerous



injurious insects and snails. The hind legs of the green frog and of the common frog are frequently eaten as delicacies abroad.

Besides the frogs mentioned the following are frequently seen in England:—

The common toad (*Bufo cinereus*), which has a very horrible appearance, owing to its body being covered with wart-like excrescences; the laughing toad (*Bombinator igneus*), the smallest of the toads, with a yellow, spotted belly; and the familiar green tree frog (*Hyla arborea*), which is frequently kept in glass cases as a weather prophet, although by no means a reliable one.

DIVISION II.—THE SALAMANDERS.

The salamanders differ from the frogs inasmuch as their bodies are longer and similar to the lizards', and also the fore legs are the first to appear in their larvæ, and they retain the tail.

The SALAMANDER (*Salamandra maculata*), Plate VI., Fig. 15, also called fire salamander, is a nocturnal animal, and is found in woods and hedges under decayed leaves and similar matters. It is frequently seen after a warm rain, as this entices its prey, the slugs, out of their holes. This slow and timid animal produces its young alive, and the latter complete their development in water. When disturbed it ejects a milk-like fluid, which is said to be dangerous to small animals; but in no way affects man.

The PROTEUS (*Proteus anguis*), Plate VI., Fig. 16, lives in the subterranean lakes in the caverns of Carniola and Dalmatia. Little is as yet known of its natural habits; it can be kept for some time in an aquarium.

CLASS V.—THE FISHES.

THE fishes are the last class of the vertebrated animals. They are covered with scales or plates, breathe by means of gills, and have cold, red blood. The elongated body generally tapers off to the tail; the head and neck are large; the limbs are called fins. The fishes live in water, and reproduce their species by eggs.

DIVISION I.—THE BONY FISHES.

These have a bony skeleton, and a well-defined vertebra, or backbone; their bodies are mostly covered with scales.

The PERCH (*Perca fluviatilis*) is found in nearly all the rivers and lakes of England. It is a gregarious fish, swimming in shoals with a rapid but jerky movement. The female lays from two to three hundred thousand eggs in the spring. The perch is very voracious, and therefore easily caught. Only small fish can be kept in an aquarium.

The SEA BREEM (*Sparidæ*) live along the coasts, feeding upon animals and vegetable matter. Their flesh is eaten. A similar fish is the saw-toothed sea bream (Plate VII., Fig. 1) of the Mediterranean.

The SEA SURGEON (*Acanthurus chirurgus*), Plate VII., Fig. 2, attains a length of from ten to sixteen inches. It is found off the coasts of the Atlantic in the Torrid Zone, and feeds upon the coral insects and weeds.

The SEA BAT (*Platax teira*), Plate VII., Fig. 3, inhabits the Indian Ocean. The dorsal and ventral fins of this somewhat small fish are of an extraordinary length, and directed backwards.

The BEAKED CHÆTODON (*Chelmo rostratus*), Plate VII., Fig. 4, can be easily recognised by the five brownish cross-bands edged with white, and by the black patch edged with white in the middle of the dorsal fin. It is from eight to ten inches long, and is found in the Indian Ocean and off the west coast of Australia.

The COMMON STICKLEBACK (*Gasterosteus aculeatus*) has on both sides thirteen to twenty plates instead of scales, and three spines in front of the dorsal fin. It is common in all British waters, and the male fish builds a curious little nest, about the size of a walnut, of small roots, weeds, etc. In this nest the female fish lays her eggs, and then the nest is not only zealously guarded and defended by the male fish for weeks, but the latter also seeks to keep the eggs and young fish well provided with fresh water by the continual movement of his fins. The stickleback is a very suitable fish for an aquarium; but is very lively and pugnacious, and therefore only one male fish with two or three females should be kept in the same tank.

The PARROT WRASSE (*Scarus cretensis*), Plate VII., Fig. 5, is an inhabitant of the Mediterranean. Its purple-red hue reminds one of the gold fish. It feeds chiefly upon mussels and crabs.

The CARP (*Cyprinus carpio*), Plate VII., Fig. 6, is found in lakes and slow-flowing rivers with muddy bottoms. Its food consists of small water insects and vegetable matter. It spawns in summer, and deposits its eggs amongst the thick rushes and reeds; a female carp sometimes deposits five hundred thousand eggs. Carp are reared in large quantities for their delicate flesh. It is a peaceful fish, and can be kept for some time in an aquarium. We may briefly mention here the barb (*Barbus*

fluviatilis), the barbel (*Carassius vulgaris*), the roach (*Leuciscus erythrophthalmus*), the minnow (*Phoxinus lævis*), the tench (*Tinca vulgaris*), the bleak (*Alburnus lucidus*), the mud fish (*Cobitis fossilis*), the suck-stone (*C. tania*), and the loach (*C. barbatula*). All these fish inhabit fresh water ; and when kept in aquariums should be fed with the pupæ of ants, grits, larvæ of insects, etc.

The GOLD FISH (*Carassius auratus*), Plate VII., Fig. 10, is a well-known fish, and a great favourite, on account of its brilliant colour. It is descended from the barbel, and is the only fish which has become a domestic pet. The gold fish is gregarious, and is very lively. It sometimes becomes so tame that it will take food from the hand, and if a bell is sounded at the feeding time it will rise to the surface at once. It is the most frequent fish found in aquariums ; but, unhappily, it does not always receive the care and attention which one expects from lovers of nature.

The HERRING (*Clupea harengus*), Plate VII., Fig. 7, is a familiar fish to everybody ; but few persons, with the exception of those living on the coasts of the North Sea, have seen it alive. It holds the first place amongst all fish. The number of herrings is something enormous ; thousands of millions are caught every year, and just as many are devoured by the larger fishes and sea birds ; but notwithstanding this it appears every year in the same immense shoals as before.

The herring attains a length of from eight to twelve inches, and inhabits the Atlantic Ocean, and the North Sea, and Baltic ; some living near the coasts (called shore herrings), and some about two hundred to three hundred miles out at sea (high-sea herrings). At the spawning season they leave their usual haunts, and make

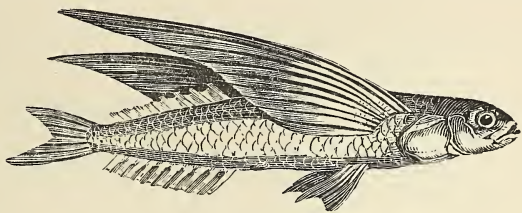
for the shores in immense shoals, in order to deposit their eggs. Here the fishermen wait for them. "At first the fish come singly, and then in such dense masses that they form quite a wall of enormous height. The whole sea is thick with fishes, over which the small boats have some difficulty in making a way; and the herrings are caught in fabulous numbers. It is said that in the Bukkafiord, Norway, two thousand boats, manned by twelve thousand fishermen, take part in the herring fishery yearly; but more attention is paid to this fishery in England than anywhere else, for in 1849 fifteen thousand boats were engaged in herring fishing, and in 1856 nearly one million tons of herrings were caught—that is, about one thousand million fish."

In the trade herrings are sold fresh, salted, kippered, dried, etc.

The PIKE (*Esox lucius*), Plate VII., Fig. 8, inhabits our lakes and rivers. Its spawning season is February and March, and it multiplies very rapidly, one fish often depositing over one hundred thousand eggs. It is a fierce and voracious robber, and attacks nearly every fresh-water fish, with the exception of the stickleback, whose spines it fears; and even ventures to attack ducks and geese. Its flesh is highly esteemed. Only small fish can be kept in an aquarium, and are then fed with meat.

The FLYING FISH (*Exocoetus*) has on each side a very long pectoral fin, which it uses as an organ of flight. When pursued by their enemies, the dolphins, sharks, mackerel, etc., they spring from two to eight feet out of the water, and shoot in a straight line over the surface of the sea for a distance of one hundred to two hundred feet. It has not yet been clearly ascertained whether they use their fins as a bird does its wings, or whether

the fins simply serve as a parachute. It is, however, a fact that they fly farther against the wind than with the wind, and this explains the circumstance that on a still day they are hardly ever seen. "Their graceful forms,



Flying Fish.

their large, clear eyes, and transparent pectoral fins give these small gazelles of the ocean a place amongst the most remarkable and beautiful of creatures." Sometimes flying fish fall upon vessels, where they are always a welcome delicacy to the crew.

THE SHEAT FISH (*Silurus glanis*), Plate VII., Fig. 9. —Next to the pike it is the most voracious fish of fresh waters. During the day it remains concealed at the bottom of the river, and when darkness comes on begins its depredations. There are two long spines on its upper jaw, and four on the lower. It attains a length of from six to twelve feet, and a weight of from one hundred to one hundred and twenty pounds. Only small sheat fish can be kept in an aquarium, and if fed with proper fish live a long time.

The COD (*Gadus morrhua*), Plate VII., Fig. 11, belongs to the family of the haddocks. It attains a length of four feet, and a weight of one hundred pounds, and inhabits the Atlantic Ocean between forty degrees and seventy-five degrees north. It is not found in the Mediterranean. In importance as a food fish the cod ranks next to the herring. On the coasts of Iceland, Newfoundland, etc., the cod fisheries form a large industry. "Five to six hundred boats bob up and down on the storm-swept

waves, and three to four thousand fishermen are continually engaged in drawing in and paying out the great nets. Along the coast are the tents and huts of these bold fishers, and above them can be seen the poles and lines for drying the fish. Here the fish are brought, boards placed upon baskets and casks serve as tables for cleaning the fish upon, and as many hands take part in the work it is completed with astonishing rapidity. With a quick and dexterous turn of the knife the fish is killed and cleaned, the head and liver are then thrown into casks, the bladder carefully removed, the sides are then rubbed with salt, and sometimes striped with the knife, and in the space of a minute the fish, which has just been seen alive, is swinging, dead and cleaned, on the pole. When dried in this way it is called stock-fish; and when salted and dried klip-fish. Its liver furnishes the cod-liver oil. The fisheries off the Scottish coasts are estimated to yield four million fish annually; the exports from Norway amount to twelve million fish in the year; and the annual value of the Newfoundland cod fisheries is upwards of £2,500,000. The haddock (*G. æglefinus*) is mostly brought to market fresh. Like the cod, it is much sought after in Catholic countries as a fish for the periods of fasting.

The SALMON (*Salmo salar*), Plate VII., Fig. 13, attains a length of from sixteen to forty-eight inches, and a weight of eleven to sixty-six pounds. In the winter and early spring it lives in the sea. In the spawning season it swims up the rivers in shoals, springing over waterfalls and weirs two to eight feet high. The eggs are deposited in the autumn on flat, pebbly spots near the source of a river. Here the young salmon live, and here they find the insects, larvæ, etc., necessary to support them. But



as soon as they are strong enough they swim down to the sea, and only visit the place of their birth when the spawning season comes on.

The flesh of the salmon is highly esteemed, and is brought to market both fresh and smoked. Not less valued are the trout, the lake trout, and the salmon trout (*S. fario*, *lacustris*, and *trutta*).

The COMMON EEL (*Anguilla vulgaris*) has a serpent like form. It is a familiar fish, and has become proverbial on account of its slipperiness and tenacity of life. In the rivers and lakes only female fish are found; the males keep to the open sea. The former go down to the sea in the spawning season (autumn); but in the following spring the young female fish swim up the rivers in immense numbers, while the young males remain in the sea. In ancient times it was believed that the eel originated with mud.

During the day the eel conceals itself in the mud, but at night it exhibits its voracious qualities by swallowing numerous fish, water insects, crabs, mussels, and worms. Its firm, delicate flesh is much esteemed. Only young eels, four to six inches long, can be kept in the aquarium, and should be fed on the pupæ of ants, meat, etc.

The ELECTRIC EEL (*Gymnotus electricus*), Plate VII., Fig. 14, which is found in Venezuela, feeds upon fish, amphibia, etc., which it stuns by its electric shocks. These shocks are so powerful that they have a stunning effect upon man, and even upon horses. The electric eel attains a length of two to four feet, and the thickness of a man's arm. The Indians drive horses and mules into the ponds inhabited by these eels, and hunt the animals round and round until the unusual noise excites the fish to attack the intruders. They can be seen

swimming in the water, and gliding under the bellies of the horses to discharge their shocks. Many of the horses succumb to the effects of powerful, invisible shocks. With flying manes, neighing, and their eyes dilated with frantic terror, the poor beasts fly from the water, but they are driven back again. The shocks become gradually less powerful; and at last, exhausted and alarmed by the stamping of the horses, the eels approach the banks, where they are harpooned.

DIVISION II.—THE CARTILAGINOUS FISHES.

The cartilaginous fishes have a cartilaginous, pliant, undeveloped skeleton, and are not covered with true scales.

The STURGEON (*Acipenser*) has an elongated body, with five rows of large bony plates along each side. The front part of the head projects downwards into a snout, and has four fleshy appendages. The length of this fish varies from three to sixteen feet, and its weight up to and sometimes over eighteen hundredweights.

Sturgeon are found in the North Sea, the Baltic, the Caspian, and the Black Sea. In the spawning season they enter the rivers like the salmon, and are therefore sometimes caught in the Rhine, Elbe, Danube, etc. The flesh of the sturgeon is savoury, and its eggs (the roe), from which caviare is made, are highly esteemed. Of the various species of sturgeon, we may briefly mention the following:—The common sturgeon (*A. sturio*), the Lichtenstein sturgeon (Plate VII., Fig. 15), the red sturgeon (*A. ruthenus*), and the huso sturgeon (*A. huso*), from the air-bladder of which a fine glue is prepared, which is used for clearing liquids, and for the manufacture of court plaster, etc.

THE SAW FISH (*Pristis antiquorum*), Plate VII., Fig. 16, varies from three to six feet in length, and inhabits the Atlantic Ocean and the Mediterranean. The prolongation of its snout—the bony saw from which the fish takes its name—forms a formidable weapon. On each side of the snout there are sixteen to twenty sharp teeth. Little is as yet known concerning the habits of the saw fish.

THE HAMMER-HEADED SHARK (*Zygæna malleus*), Plate VII., Fig. 17, is chiefly found in the waters of the Torrid Zone, but is also met with in the Mediterranean. “The horrible deformity of the head, with the glaring green eyes at the edges, is as strange as it is terrible.” The hammer-headed shark attains a length of thirteen feet, and produces living young, about forty at a time.

THE WHITE SHARK (*Squalus carcharias*), Plate VII., Fig. 18, is chiefly found in the Atlantic; it attains a length of thirteen feet, and is one of the most dreaded of finny pirates. Its jaws are furnished with about four hundred sharp teeth, and are three feet in diameter. “The shark is the pirate of the deep, and, like the feline animals of the land, nature has furnished it with almost irresistible weapons of attack. Its boldness equals its strength and voracity. Just as the lion follows the caravan, so the shark follows the vessel, and at last captures its victim with a lightning-like spring. Its sharp scent often leads it to swim a distance of two to three miles after a corpse sunk in the sea; but, like the tiger and the crocodile, it is most voracious for the flesh of the black man. The boldness to which its bloodthirsty nature pushes it is scarcely creditable. It is related that a shark tore down the body of a negro hanging on a yardarm nineteen feet above the water, in face of the crew. Its excessive voracity is shown by the fact that a shark was caught

weighing fifteen hundredweights, and in its belly a horse was found, which had apparently been thrown from a vessel."

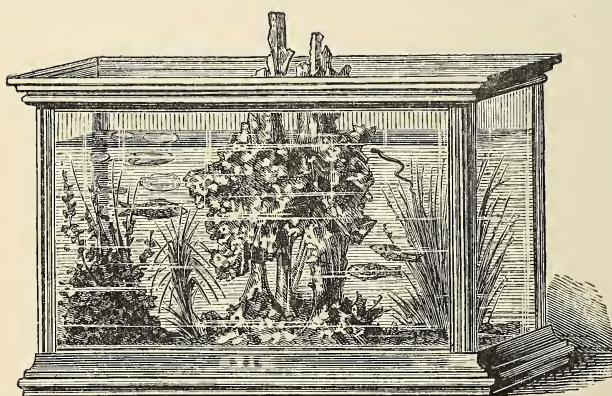
The shark is caught with large, barbed hooks fastened to strong chains, and also with harpoons. The great strength of the fish always renders the hunt dangerous. Its flesh is scarcely eatable, but a useful oil is obtained from its fat.

The LAMPREY (*Petromyzon marinus*), Plate VII., Fig. 12, is found off the coasts of Europe and North America, and attains a length of three feet, and a weight of three pounds. In the spring it enters the rivers to deposit its eggs. Its food consists of insects, worms, and small crabs; frequently, however, the lamprey sucks other fish (for example, the salmon), and lives upon their juices. Its flesh is much esteemed.

At the end of this section we give a few hints on the

Arrangement and Management of a Fresh-water Aquarium.

A fresh-water aquarium not only serves for the study of



Fresh-water Aquarium.

fishes inhabiting the rivers, lakes, and ponds, but other inhabitants of the water can also be kept in it, such as water in-

sects, snails, etc. When properly arranged, it brings

under our close observation the habits and movements of the most strange and most unfamiliar creatures, and it also furnishes the most casual observer, as well as the most observant naturalist, with daily subjects for new discoveries and new observations.

Of the various aquariums we may mention (*a*) The globe aquarium (fish globe), which is by no means to be recommended, as it is very small, and further, in the summer the water must be renewed nearly every day, which greatly disturbs the fishes. (*b*) The vase-shaped aquarium, which generally consists wholly of glass, the crinkled sides of which only permit of a close observation of the fish from above, and this aquarium is therefore not so serviceable as (*c*) the square aquarium. The latter is either four, six, or eight-sided, and has straight walls of glass, which are fastened in iron frames. When inserting new glass, a mixture should be used consisting of three parts putty, one part white-lead, one part red-lead, and some varnish.

The bottom of the aquarium should be covered with two to four inches of clean, well-washed river sand, upon which small pebbles should be laid. In the centre of the reservoir a pretty tufa-stone rockery is built, with a cup-like opening at the top for the reception of a water plant. If a fountain is introduced, the pipe passes through the rockery. Having thus arranged the aquarium, it should be placed near a window with an eastern aspect if possible. But we must now put in some water plants. The latter utilise the carbonic acid gas arising from the respiration of the fish and insects, and from the decomposition of the organic matters, and from the excrementa; and with the aid of the chlorophyll (the green colouring matter) they separate this gas into oxygen and

hydrogen: the latter they use for building up their organs; but the former they return to the fish for the purposes of respiration. The most suitable plants for an aquarium are the water aloe (*Stratiotes aloides*), the frog-bit (*Hydrocharis morsus ranae*), the elodea (*Elodea Canadensis*), the utricularia (*Utricularia vulgaris*), the duck's weed (*Lemna*), the horn-wort (*Ceratophyllum demersum*), the milfoil (*Achillea millefolium*), the star-wort (*Callitriche verne*), and the screw-stalked vallisneria (*Vallisneria spiralis*), etc.

A number of these plants are pure swimming plants, and need only to be simply placed in the water. Those which have their roots in the earth should be planted in suitable spots before filling the aquarium. The aquarium is filled in the following manner:—The sand and plants are covered up as far as possible with some sheets of blotting-paper and newspaper; the pure spring water is then slowly let in by means of an india-rubber pipe; at the same time the paper is carefully taken away.

The fish and insects must now be put in. These fall into two groups: (a) Those which breathe in the water—fish, crabs, water snails, etc. (b) Those which come to the surface to breathe—amphibia, water insects, land snails, etc. And if one is careful to bring about a proper relationship between the water plants and the water animals on the one side, and between the real inhabitants of the water and those which come to the surface to breathe on the other side, the management of the aquarium will require little trouble. The fish, etc., are best fed upon small water insects (mussels, crabs, dun flies, and gnats' larvæ), which in the summer are found in large quantities in puddles and on the edges of ponds; with flies, slugs cut up, shavings of lean beef, pupæ of ants,

crushed white wafers, grits, bread crumbs, etc. But food must not be given too often, and never too much at once. In the summer it should be given daily; in the winter twice or three times a week.

If in the hot period of summer the water should become too warm, a third part should be drawn off, and fresh water allowed to flow in slowly. The green layer (algæ) which settles on the glass walls should be slowly rubbed off with a small, stiff brush. As it sinks to the bottom it can be cleared off with the accumulated excrementa by trailing the upper edge of the india-rubber tube over the layer of sand.

Further hints are unnecessary for all who make observations in nature on the ponds, lakes, and rivers. And as it is intended that the readers of this book should be especially induced to make their own observations, we now refer them to Nature herself, who is the best instructress. Therefore, let us now go out to the ditch and pond, to the lake and river. A small net similar to a butterfly net serves to catch our specimens. Let us place the captured fish, etc. in the aquarium, and study them diligently, and we shall soon be familiar with a section of Nature which is rich in beauties, and so much the more interesting because we rarely have opportunities of observing it.

CLASS VI.—THE INSECTS.

THE insects are the first class of the invertebrate animals; and their bodies, consisting of a series of rings, are divided into three sections: the head, the thorax, and the abdomen. In the head are the jaws; the antennæ, or feelers; and the eyes, which are motionless. Besides

the latter, there are also here and there rudimentary eyes, called "point-eyes."

All insects undergo a series of changes (metamorphoses). From the egg first comes the larva (caterpillar, maggot); from the larva, after several changes of the outer skin, the pupa is developed; from which, after a longer or shorter period of repose, the perfect insect emerges. In some, such as the dragon flies, the whole course of metamorphosis, or change, is not gone through; for in the dragon flies the larva which comes from the egg resembles the full-grown insect, only it is without wings; but later, without entering the pupa stage, it develops into the perfect insect. There are altogether about two hundred thousand various kinds of insects.

DIVISION I.—THE BEETLES.

The beetles have four wings; the front pair are horny, and are called "wing-cases;" the hind pair are membranous. The jaws of the beetles are used for biting. These insects pass through the full course of changes.

THE BASTARD SAND BEETLES (*Cicindela hybrida*), Plate VIII., Fig. 1.—The bastard sand beetles are very active beetles, and are found in dry, sandy spots; they prey upon other insects. These beetles run with extraordinary rapidity, as may be supposed upon glancing at their long, slender legs; and their flight is jerky. If we want to catch one of the sparkling creatures we must seize it quickly; but the captive tries to escape, and bites savagely with its upper jaws, which are bent and shaped like sickles. The larvæ of the tiger beetles are also armed with powerful jaws, and live concealed in perpendicular holes in the sand. Besides the bastard tiger beetle, the common tiger beetle (*C. campestris*) and

the wood tiger beetle (*C. sylvatica*) are also worthy of mention.

The CORIACEUS BEETLE (*Procrustes coriaceus*), Plate VIII., Fig. 2, is found in all parts of Europe, and is generally seen in damp, shady spots, and also in woods. During the day it lies concealed under a stone; but at night it goes on the hunt for prey. Its larva, which is rather large, feeds chiefly on young snails. The Carabidæ proper closely resemble this beetle in shape and habits. Of the ground beetles the chief are the gold beetle (*Carabus auratus*), which is found in the fields in summer-time; the spotted beetle (*C. granulatus*); and the violet ground beetle (*C. violaceus*). In the ground beetles the wings are either wanting entirely, or are rudimentary. Like the tiger beetles, they feed upon insects of all kinds, and are therefore very useful in the gardens and fields.

The CALOSOMA SYCOPHANTA, Plate VIII., Fig. 3, is chiefly found in woods, where it climbs the trees and preys upon various kinds of larvæ and caterpillars, especially those of the night butterfly and procession moth. The larva, which has six legs, and is black on the upper parts and white beneath, also preys upon insects, even attacking the female butterflies and eating the eggs in their abdomens. The calosoma is frequently seen in Southern and Eastern Europe, and should be spared on account of its useful habits.

The GREAT WATER BEETLE (*Dytiscus latissimus*), Plate VIII., Fig. 4, is from one and a half to two inches long. The margins of the disc of the thorax, the edges of the wing-cases, and the under parts of the beetle are yellow. It is found in lakes and ponds, and commits great ravages amongst the fish; its elongated larva

also attacks small fish. A better-known species is the common water beetle, which, although nearly half an inch shorter, bears a close resemblance to its bigger relation. The larvæ of the water beetles, after attaining their full size, make an oval burrow in the bank, in which they change into the pupal form. In Summer the perfect insect emerges from the pupa in a few weeks, but when the pupal stage begins in Autumn, the perfect insect does not emerge until the following Spring.

The BLACK WATER BEETLE (*Hydrophilus piceus*), Plate VIII., Fig. 5, can be seen throughout the year in nearly all large bodies of still water. It is one of the biggest of our insects, attaining a length of two and a half inches. Before the female deposits her eggs, she spins on the surface of the water a small kind of nest, which has a cover to it. In this nest the eggs are laid in April, and in two to three weeks the elongated larvæ appear. The latter feed upon all kinds of water insects, and pass the pupal stage in the same manner as the larvæ of the great water beetle. Both the black water beetle and its larva are injurious to fish-breeding. It may be mentioned here that water beetles can be kept in an aquarium ; but, in order to enable the larvæ to undergo their change, a piece of turf should be placed on the rock-work, in which they can pass the pupal stage.

THE ROUGH-HAIRED ROVE BEETLE (*Staphylinus hirtus*), Plate VIII., Fig. 6.—The rove beetles, or Staphylinidæ, have short wing-cases, thus leaving a portion of the abdomen uncovered. They are generally found on the ground, under stones, moss, dung, etc. The larvæ closely resemble the beetles, but they are without wings and wing-cases. In the sunshine these beetles are very lively, and delight to fly about. Their

food consists of insects and decaying animal and vegetable matter. The royal rove beetle (*St. Casareus*), which may easily be recognised by the gold patches on the abdominal rings, is much more common than the rough-haired rove beetle.

THE GERMAN BURYING BEETLE (*Necrophorus Germanicus*), Plate VIII., Fig. 7.—A better-known burying beetle is the *Necrophorus vespillo*, which can be recognised at once by two reddish-yellow irregular stripes running across the black wing-cases. The burying beetles fly about chiefly in the spring and summer. They deposit their eggs in the dead bodies of small animals, which they first bury. If the dead animal lies upon hard or stony ground, they drag it to a suitable spot; the beetles creep under it, and the body is slowly moved forward. Should their efforts prove unsuccessful the beetles fly off, and in a short time return with fresh comrades. The larvæ are full grown in about four weeks after leaving the eggs; they then enter the pupal stage, and fourteen days later the beetles emerge. Everybody should spare the burying beetles, since they clear off much decomposed animal matter, which would otherwise taint the purity of the air during the hot weather.

The HISTER CADAVERINUS, Plate VIII., Fig. 8, is frequently met with, and lives in dung-heaps, where it feeds upon decomposed matter; but it also attacks small insects. The histers move slowly, and on warm evenings fly short distances in search of fresh food. As soon as they suspect the approach of danger they pretend to be dead.

The DERMESTES OR LARDER BEETLE (*Dermestes lardarius*), Plate VIII., Fig. 9, lives in the open air upon

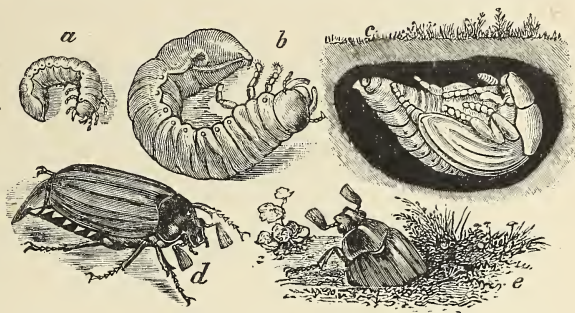
decomposed animal matter; but it is frequently found in houses, where it is destructive to furs, hides, meat, stuffed animals, etc. In these it also deposits its eggs, and the long, hairy larvæ which emerge from the eggs are as destructive as the beetles. When disturbed the latter pretend to be dead. The fur beetle (*Attagenus peltio*) has similar habits.

The STAG BEETLE (*Lucanus cervus*), Plate VIII., Fig. 10, is the largest of our British beetles, and is found in the woods. The long, notched mandibles of the male beetle form a fine pair of antlers, and also serve as weapons of defence. Its food consists of the outflowing sap of the oak, which it licks up with its brush-like tongue. The larvæ of the stag beetle live in the rotten wood of the oak, and require five years for their development into the perfect insect.

The HORNED DUNG BEETLE (*Geotrupes typhæus*), Plate VIII., Fig. 11, is found in meadows, in cow and sheep dung, under which it excavates holes in which to deposit its eggs, the holes being filled up with dung. Only the male is provided with the three horns projecting from the disc of the thorax. A much commoner species is the common dung beetle (*G. stercorarius*), which is found in horse-dung everywhere. It is black or bluish black on the upper parts, and violet below. Very similar but much smaller species are the wood dung beetle (*G. silvaticus*) and the spring dung beetle (*G. vernalis*).

The COCKCHAFER (*Melolontha vulgaris*) belongs to the hurtful insects. It flies generally in May, but sometimes earlier and sometimes later. In the male the antennæ or feelers (*d*) are furnished with seven somewhat larger lamellæ or plates; in the female the antennæ have only six small plates. The female deposits in the earth about

seventy eggs in little heaps of twelve to thirty each, and then dies. The larvæ (*a*) which emerge from the eggs are well known, and are as destructive as the full-grown beetles. They feed upon the roots of all kinds of grasses and plants, and even gnaw into the roots of young fruit trees. Al-



Cockchafer.

though they are very voracious they grow but slowly, and do not fully develop until they are two and a quarter or three and a quarter years old. During this period they frequently cast their skins, which become too small for the growing insects. Towards the end of the summer the fully developed larva (*b*) burrows deeper into the earth, where it makes a roomy compartment in which to lie, and leaves off eating. Its skin then bursts again, and a pupa (*c*) appears, which is almost motionless, and takes no nourishment whatever. In the pupa the wonderful process goes on, resulting in the production, from a long fat larva, of a beetle with wings: another creature altogether. The latter leaves the pupa-case in about two months, and slowly works its way out of the earth (*e*), generally so as to make its appearance in the month of May, when its food is young and green. It feeds on the leaves of several trees, such as the oak, maple, horse chestnut, willow, birch, and poplar; and especially upon those of fruit trees.

Of course this beetle is destroyed wherever it is found,

and is most successfully coped with by collecting the cockchafers every three or four years, according to the periods of their development.

The NASICORNIS BEETLE (*Oryctes nasicornis*), Plate VIII., Fig. 12, is often seen in June and July. It generally deposits its eggs in oak bark, manure beds, and hollow trees. In these positions the larvæ live for several years, and pass through the pupal stage in the same places. The larvæ are not liked by gardeners, since they are frequently injurious to the hot-beds of tan.

The FULLER BEETLE (*Polyphylla fullo*), Plate VIII., Fig. 13, also called the miller and tanner beetle, is very rare in some districts, and in others is often met with. It is found in woods, and has an especial liking for pine trees, to which it is often injurious. Its larva lives in the earth, and feeds upon the roots of grasses.

The GIANT EUCHROMA (*Euchroma gigantea*), Plate VIII., Fig. 14, is found in South America, especially in Brazil. Its larva lives in the wood of trees, as do also the larvæ of our own small beetles of the same species, the Buprestidæ. The natives of Brazil wear the metallic-sounding wing-cases of the *Euchroma* strung upon thread as necklaces.

The CORYMBETES ÆNEUS, Plate VIII., Fig. 15, is, like many of its relatives, frequently found upon blossoms. If placed on its back, it jerks itself into the air and falls upon its feet, at the same time emitting a cracking noise. The larva lives in the earth, and feeds upon roots and other vegetable stuffs. It is elongated and spiral, and is only too well known to gardeners as the "wire worm."

The GLOW WORM (*Lampyris splendidula*), Plate VIII., Fig. 16, possesses at the end of the abdomen several luminous rings. At night it flies about here and there,

and at once attracts attention. The female, which is found in grass at damp spots, is without wings. The larvæ live in rotten trees.

The BEE EATER (*Trichodes apiarius*), Plate VIII., Fig. 17, is often seen upon flowers in the summer. It has a rapid flight in the sunshine, and to catch it requires dexterity. Its red larvæ are sometimes found in hives, where they feed upon the bee grubs.

The SPANISH FLY (*Lytta vesicatoria*), Plate VIII., Fig. 18, is in some years met with in large numbers upon ash trees, elders, honeysuckles, privets, maples, poplars, and larch trees. The Spanish fly appears in June, and its flight is vigorous in the sunshine. It can be recognised at some distance by its peculiar narcotic odour. The female deposits about forty-five eggs in the earth; the larvæ feed upon berries.

These beetles are collected and dried, and when finely powdered are made up into the familiar Spanish plaster, which has blistering properties.

The COMMON MAY WORM (*Meloe proscarabæus*), Plate VIII., Fig. 19, is very common in the lanes and grass in spring. The larvæ, which are two millimètres long, and yellow, lie in wait in flowers for the bees, to which they cling by fastening themselves to their hairy bodies, and are thus carried into the hives. Here they feed first upon the bees' eggs, and afterwards upon the honey; but they leave the hive before reaching their pupal stage.

We may briefly mention here the pea beetle (*Bruchus pisi*), found in peas; the seed beetle (*B. granarius*), found in various leguminous vegetables, especially in horse beans; and the lentil beetle (*B. lentis*), found in lentils.

Of the vast group of beetles known as weevils

(*Curculionidæ*), which numbers many harmful species, the following should be noticed :—The oak weevil (*Attelabus curculionides*), which is red on its upper parts, and from May to July rolls up numerous leaves on the oak trees ; the poplar weevil (*Rhynchites populi*), which curls up the leaf of the poplar ; the steely-blue vine weevil (*Rh. betulati*), which rolls up the leaves of various trees and shrubs ; the copper-coloured plum weevil (*Rh. cupreus*), which deposits its eggs in young plums and damsons, and gnaws through the stalks for this purpose ; the branch weevil (*Rh. conicus*), which lays its eggs in the tops of young shoots, which it afterwards gnaws off so that they wither ; the fruit weevil (*Apion pomonæ*), which is found upon all fruit trees, and gnaws off the young shoots and blossoms ; the various species of leaf weevils (*Phyllobius*), which are also frequently met with on fruit trees ; the large brown weevil (*Hylobius abietis*), one of the most harmful of wood insects, which gnaws through the bark of the fir tree ; the apple weevil (*Anthonomus pomorum*), a common and harmful little beetle, which deposits its eggs in the buds of the apple tree in April ; its larvæ feed upon the buds, so that the blossoms look as though they were burnt ; the nut weevil (*Balaninus nucum*), the larva of which feeds upon the kernel of the hazel nut ; the acorn weevils (*B. glandium* and *B. turbatus*), whose larvæ devour the kernel of the acorn ; the brown corn weevil (*Calandra granaria*), the larva of which frequently does great damage in the granary.

The PALM WEEVIL (*Calandra palmarum*), Plate VIII., Fig. 20, is a native of South America. Its larvæ live in the branches of the palm, and are eaten by the inhabitants.

The BLACK FIR-BARK BEETLE (*Hylastes ater*), Plate



VIII., Fig. 21, flies in April and May. The larvæ live under the bark of the fir trees, and are harmful.

The COMMON BARK BEETLE (*Bostrychus typographus*), Plate VIII., Fig. 22, also called the printer beetle, is very common and very harmful. It flies at the same period as the black fir beetle, and generally deposits its eggs under the bark of the pine. It first bores a perpendicular hole, on the right and left of which it makes short passages, in which the eggs are deposited. The larvæ enlarge and lengthen these passages in the same direction, and in these passages, forming a cradle, they undergo their metamorphosis.

The following examples will give some idea of the great destructiveness of bark beetles. At the end of the last century they completely destroyed, in a few years, four thousand acres of pine wood in the Harz Mountains (Germany); and in the year 1783 nearly two million trees decayed in the same districts, owing to the ravages of these beetles. The beetles formed dense clouds, and on four trees over two thousand three hundred pairs were counted.

The OAK MUSK BEETLE (*Cerambyx heros*), Plate VIII., Fig. 23, is from one to two inches in length, and with its long antennæ is a beautiful beetle, which, in June and July, is seen here and there on oak trees. Its larvæ, which are sometimes three inches long, and yellowish-white, live for several years in the wood of old oaks, boring it through in all directions. During the day the beetles remain concealed in their burrows, but in the evening they can be seen in large numbers.

The MUSK BEETLE (*Aromia moschata*), Plate VIII., Fig. 24, is recognisable by its beautiful bluish-green wing-cases, and more especially by the strong musk-like

scent it emits. It is found in July and August in old willow trees, in the wood of which its larva lives.

The CLYTUS ARCUATUS, Plate VIII., Fig. 25, is well known, and is found chiefly on fallen oaks. Besides the long-horned beetles already described, we may briefly mention the *Hylotrupes bajulus*, the larva of which bores irregular passages in roof-joists, wooden vessels, etc.; the *Lamia textor*, the larva of which lives in willows and poplars; and the great poplar beetle (*Saperda carcharias*), the larva of which lives nearly two years in willows and poplars, and destroys the young branches.

The GREAT POPLAR CHRYSOMELA (*Chrysomela populi*), Plate VIII., Fig. 26, is very common upon willows and poplars. Its larvæ destroy the leaves with the exception of the ribs, and are consequently extremely harmful. It belongs to the Chrysomelidæ, of which species the following are also very common and more or less harmful:—The asparagus chrysomela (*Lema asparagi*), found on asparagus; the red-foot chrysomela (*Luperus rufipes*), found in May on fruit trees and hedges; and the common spring-tail (*Haltica oleracea*), so common upon vegetables.

The LADY BIRD (*Coccinella septem-punctata*) is familiar to everybody. It lays its eggs on plants where there are plenty of aphides. The larvæ feed on the latter, and are thus useful. The pupæ cling to the leaves, and on being disturbed elevate and depress the hind part of the body with a regularity equalling that of the hammer which strikes the gong of a clock. Another species almost as familiar is the *Coccinella bipunctata*, which has only one black spot on each wing-case.

For those who wish to study beetles more closely, and therefore desire to make a collection, a few hints on the

capture, preparation, and preservation of beetles will be welcome.

The beetle collector has, in the first place, to become acquainted with the various localities where specimens are to be found ; for all beetles are not to be caught by merely looking around. Search must be made under large stones, beneath leaves and moss, amidst decaying animal and vegetable matter, and in dung ; bark must be loosened from old trees ; masses of fungi must be broken up, and bushes swept over with a net or open umbrella—the latter must be held open under trees and shrubs, and the beetles knocked off into it ; the beetles living in rivers and lakes must be caught ; and specimens should also be obtained of those beetles which live upon ants, wasps, and hornets.

The captured beetles which are black and hairless are killed by placing them in a glass bottle with spirits ; the coloured and hairy specimens are soon killed by placing them in a closed bottle containing three to five drops of ether or benzine upon blotting paper or wadding.

After the beetles have lain for a few hours in alcohol or have been killed in some other way, they are mounted. For this operation special mounting pins are required. In the larger beetles the pin is inserted in the left-hand top corner of the right elytra or wing-case, and passed through the body so that it comes out between the second and third pair of legs. The smaller beetles are fastened, by means of gum with a little sugar added, to the edges of wedge-shaped strips of paper about half an inch long, so that the legs hang free right and left. In order that all the specimens may be on a level, about half an inch of the pin is left



projecting above each insect. In the case of the smaller beetles the pin goes through the broad end of the paper strip.

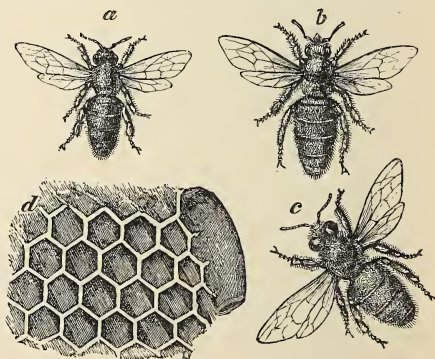


The collection of beetles is then placed in a box with a good lid, or in a proper entomological cabinet, and great care should be taken to prevent the specimens being injured by insects, dust, mould, etc. Finally, it should be remembered that the mere collection of a great number of beetles for the sake of collection alone is not the chief object to be aimed at; but we should rather penetrate into the mysteries of Nature by continued observation and research. Only when we do this will Nature furnish us with a source of pure pleasure from day to day.

DIVISION II.—THE HYMENOPTERA.

The hymenopterous insects have mouths furnished with jaws for biting, and a tongue; four homogeneous, transparent membranous wings, traversed by few veins, the front pair being always larger than the hind pair; and they pass through a complete course of metamorphosis.

The HIVE BEE (*Apis mellifica*) is found over a large area of the earth, but rarely occurs wild in the woods of England. It is largely kept, however, in variously shaped hives. A colony



Bees.

always consists of three separate kinds of bees, very

unequal in numbers. There are always ten to thirty thousand working bees (*a*); only one female bee, the queen bee (*b*); and during the summer from two to three hundred male bees or drones (*c*). The whole of the construction built by the working bees consists of perpendicularly placed combs (*d*), which fill up the interior of the hive. Every comb is formed of a thin wall, on the front and back of which horizontal cells of wax are moulded. Each cell is hexagonal or six-sided, thus having a form which leaves no space unused. The cells serve for the reception of the honey, the pollen, the eggs, and the larvæ. The building material is wax, which is prepared in the bee's stomach, and pulled out from between the middle ventral rings.

The queen bee lays over a million eggs during her life, and the larvæ emerge from the egg, as a rule, in three days. The larvæ are then tenderly looked after by the working bees, and, when they have developed, their respective cells are closed up with wax. The enclosed larva then enters the pupal stage, and the perfect bee emerges a little later, when, if a worker, it immediately takes part in the labours of the hive, there being always a lot to do.

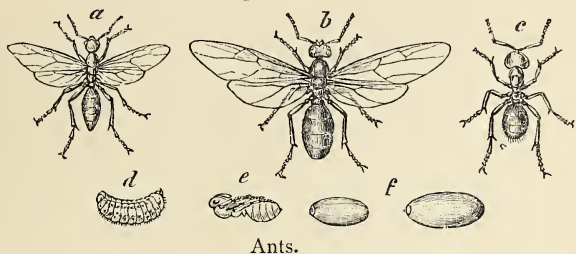
The drones' cells are larger than those of the working bees, but the cells for the queen bees are very different from the rest. They are considerably larger and oval, and are situated at the edge of the comb. The larva resting in a cell of this kind is fed upon better food, and consequently grows quicker. At the end of sixteen days the larva has completely developed into a queen bee, and suddenly begins to hum, the noise exciting the old queen almost to madness. The latter runs angrily all over the combs, followed by drones and workers. She

attempts to sting the interloper to death, but is prevented by the working bees. The disturbance in the colony increases until the old queen leaves the hive, attended by a few thousand bees, and swarms for a short time in the air. The whole colony soon suspends itself from the branch of a tree, or from some other support, and it is then captured by the owner of the hives. The captured bees now accommodate themselves to a new hive, clean it, and begin to build the combs. Towards the winter the workers attack the drones, and either kill them or drive them out. The last fine days in autumn are usefully employed, for the late-blooming sweet broom offers rich stores of honey, so that after hard work the bees can meet the winter without anxiety.

Bee-keeping has been practised from the earliest times. In good years the yield of honey and wax is considerable. The bees deserve our full admiration on account of their diligence, cleanliness, love of order, and the skilled industry they exhibit in the construction of their cells. Related to the hive bees are the flat and hairy humble bees, which make a buzzing noise when flying.

The WASP (*Vespa vulgaris*) is familiar, like the working bee, on account of its sting; it is very common, and is disliked, as it sucks the juices from honey, plums, grapes, and other sweet fruits. In the wasps' nest we also find a female, males, and workers, which are distinguished one from another by the difference in their sizes. Only the females live through the winter; they form new colonies, and attract the males and workers, which are again destroyed by the first frost of Autumn. The largest wasps, the hornets (*V. crabro*), build their nests in hollow trees and under roofs. They are more feared than the wasps, as their sting is very painful.

The WOOD ANTS (*Formica rufa*) are found in the woods, where they erect a strong edifice of bits of wood, pine needles, gum, small stones, etc., over their dwelling, which is situated in the



earth. Here also we meet with three classes: winged males (*a*), and females (*b*), and wingless workers (*c*). The eggs, larvæ (*d*), and cocoons (*f*), in which the pupæ (*e*) lie, and which are sometimes erroneously called "ants' eggs," are affectionately looked after by the workers. When the sun shines they are carried by the workers to the surface of the ant-hill, but on disturbance, or the approach of rain, the workers carry them off again to the inner chambers.

The workers build the dwelling, bring in the food, attend to all the duties of the colony, and defend the nest with great courage. They hold well together, help each other with heavy loads, and when two meet, the one carrying nothing makes way for a loaded comrade.

The ants live upon animal and vegetable matter, but are especially fond of sweet liquids. As they destroy insects they may also be included with the useful insects. It may be mentioned here that many ants steal pupæ from other nests, and keep the workers which emerge from the stolen pupæ as slaves; and that others keep aphides and various beetles as "cows," as these insects furnish a sweet liquid of which the ants, as already mentioned, are extremely fond.

The ICHNEUMONS (*Ichneumonidae*) have a thin body

the thorax is separated from the abdomen by a deep depression, and in the female at the end of the abdomen there is an ovipositor.

The ichneumons are the enemies of their own race, for they all live as death-bringing parasites in other insects, both in the eggs, larvæ, and pupæ; also in the eggs of spiders, and in the galls on plants. The eggs which they deposit in the bodies of other insects produce in a short time the larvæ, which grow vigorously in their "hosts." This is not noticeable in the "host" or insect in which they live—for instance, in the caterpillars—as the larvæ only prey upon the juices, and do not injure the organs. When the caterpillar is developed and about to enter the pupal stage, the larvæ of the ichneumon are also ready for change, and bore their way out; and the caterpillar dies, being often perforated in a hundred places. But the larvæ of the ichneumon immediately spin their cocoons; and as the cocoons of many kinds are very small and oval, and generally found in the neighbourhood of a caterpillar, many people erroneously suppose these cocoons to be caterpillars' eggs, but caterpillars never lay eggs.

Sometimes, however, the caterpillar succeeds in entering the pupal stage, taking the larvæ of the ichneumons with it. The latter now also become pupæ; and, instead of the beautiful butterfly which we expected, an ichneumon emerges from the case. Other ichneumons spare the caterpillars by waiting until they have entered the pupal stage, when they insert their eggs in the pupa while it is yet soft. Some idea may be obtained of the smallness of many ichneumons when we learn that whole colonies develop in a butterfly's egg of the size of a millet grain. An ichneumon of this kind will deposit

twelve to eighteen eggs in the egg of the *Lasiocampa pini*. In this tiny dwelling the larvæ live; they feed upon the yolk of the egg, pass their pupal stage, and finally leave the egg as perfect insects, by a common exit of the size of a needle's point.

Other ichneumons again live as parasites in aphides, in the larvæ of gall wasps, in the pupæ of water insects, and in the larvæ of tree beetles, etc. A few kinds attack one special insect, others choose several insects, and others again attack any insect which is handy.

Of what importance are the habits of these insects? They must prevent the too rapid increase of those plant-devouring insects which often appear in such terrible numbers in the fields, gardens, and woods. And this they do. For example, however numerous the harmful caterpillars of the cabbage butterfly may be, the ichneumons are just as numerous; and of a hundred caterpillars often only ten become butterflies. In order, however, that they may not do too much good, there are also ichneumons which deposit their eggs in the larvæ of other ichneumons. And thus, for example, in one caterpillar there lives a number of larvæ of ichneumons, which we may call the first "lodger;" and in the latter, again, larvæ of ichneumons are living—the second "lodgers." Only the latter develop into insects; the first lodgers must die as well as the "host." Butterfly collectors, when expecting the development of a fine specimen, are often disappointed by the ichneumons, as the caterpillars which they have collected are frequently already inoculated with the ichneumon's eggs.

THE OAK LEAF GALL INSECT (*Cynips Quercus folii*).
—Towards the autumn we frequently observe the

so-called gall apples in large quantities on the under side of oak leaves. They are produced by small Cynipidæ or gall insects, which deposit their eggs in the ribs of the leaves. This causes an increased flow of sap to the spot in order to heal the wound, which is, however, constantly kept open by the larva. Thus there gradually forms round the insect a bullet-shaped, yellowish-green gall as large as a cherry. In this the metamorphosis of the gall insect takes place, and the perfect insect leaves the gall by making an opening for this purpose.

The GIANT WOOD WASP (*Sirex gigas*), Plate XII., Fig. 1, deposits its eggs in the wood of the fir and pine. The larvæ bore winding passages, and require two years for their complete development. They are frequently introduced into houses in building-wood and planks, and then one day we see the large wasp after it has left its abode. The female wasp can be easily recognised by the ovipositor which projects from the middle of the abdomen.

DIVISION III.—THE LEPIDOPTERA.

The Lepidoptera or butterflies have four homogeneous, membraneous wings, which are covered with dust-like coloured scales. The mouth organs form a proboscis, with which they suck. They undergo a complete course of change.

The SWALLOW-TAIL BUTTERFLY (*Papilio Machaon*), Plate IX., Fig. 1, flies in July and August, and deposits its eggs on carrots and other umbelliferous plants. The caterpillar (1 *a*) is green, and has black bands with red spots. They change into a greyish-green pupa while clinging to a stalk, and the beautiful butterfly generally emerges when the winter is over. A very similar



butterfly is the *Papilio Podalirius*, the larvæ of which feed upon sloes and other plants.

The APOLLO BUTTERFLY (*Parnassius Apollo*), Plate IX., Fig. 2, flies in July, and deposits its eggs on stone-crop. The caterpillar is black with yellowish-red patches. It changes, while enveloped in a cocoon in the earth into a blue-sprinkled pupa, from which the apollo emerges after fourteen days. The latter is white; on the fore wings there are large patches, and on each of the hind wings two red eye-like flecks. The apollo is found in the Alpine districts.

The GREAT CABBAGE WHITE BUTTERFLY (*Pieris brassicae*), Plate IX., Fig. 3, is common everywhere, and appears twice in the year, first from April to June and then from July to September. The female deposits its eggs on the various kinds of cabbages, radishes, etc. The caterpillar (3 *a*) is either bluish or a dull yellowish green, with yellow stripes on the back and sides. It passes the pupal stage on hedges, walls, etc., and is very frequently a host for the larvæ of the ichneumon beetle. The pupæ (3 *b*) are yellowish; those of the first generation produce the butterfly after two or three weeks, while those of the second generation go through the winter. The small cabbage white butterfly (*P. rapæ*) and the hawthorn butterfly (*Aporia crataege*) may also be mentioned here.

The BRIMSTONE BUTTERFLY (*Colias rhamni*), Plate IX., Fig. 4, is a favourite harbinger of spring, which flies already in March and April. Its dark-green caterpillar (4 *a*) lives upon the berry-bearing alder and the buckthorn, and changes, in the fork of a branch, into a pointed green pupa (4 *b*), from which the butterfly (4 *c*) emerges after four to six weeks. It is common all over Europe.

THE BROWN ARGUS (*Polyommatus virgaureæ*), Plate IX., Fig. 5, has beautiful reddish-gold wings with dark-brown borders. It flies in the woods in July and August, and deposits its eggs on the sorrel, wild thyme, and groundsel. The caterpillar is small and dark green, and changes into a brownish pupa while clinging to stems of plants. The pupal stage lasts four to six weeks.

THE COMMON BLUE FRITILLARY (*Lycæna Argus*), Plate IX., Fig. 6.—The male butterfly, shown on the plate, is of a beautiful reddish blue, while the female is of a dark-brown colour, with more or less distinct reddish-yellow spots on the margins. This graceful butterfly is met with in meadows in June and July. It deposits its eggs on trefoil. The caterpillars and pupæ are brownish green; and the pupal stage lasts two or three weeks.

THE SMALL TORTOISESHELL BUTTERFLY (*Vanessa urticæ*), Plate IX., Fig. 7, is a very common butterfly, and is met with in the early spring, and again from July to October. The caterpillars (7 *a*) are either yellow with lighter stripes, or blackish with yellowish stripes. They live upon nettles, where they are generally found, full grown, in large numbers in July and in September. The pupæ (7 *b*) are greyish brown with gold spots, and they produce the butterfly generally after fourteen days. Very similar to this butterfly is the *Vanessa polychlorus*, the caterpillars of which feed upon fruit trees, elms, and willows in May and June.

THE PEACOCK BUTTERFLY (*Vanessa Jo*), Plate IX., Fig. 8, has a gorgeous eye-like patch on each wing. This butterfly is met with at the same periods as the former, and its black, hairy caterpillar (8 *a*) also lives upon nettles. The pupa (8 *b*) is greenish brown, and has a golden glitter. The pupal stage lasts fourteen days.

The CAMBERWELL BEAUTY (*Vanessa Antiopa*), Plate IX., Fig. 9, has velvety-brown wings with sulphur-yellow margins and violet patches. This beautiful, somewhat common, butterfly also flies twice in the year—in the spring, and from July to September. It deposits its eggs on birch trees, willows, and poplars, upon which its hairy caterpillar (9 *a*), with red spots, is always found in large numbers. The hanging pupa (9 *b*) is a brownish grey; the pupal stage lasts from fourteen days to three weeks.

The RED ADMIRAL (*Vanessa Atalanta*), Plate IX., Fig. 10, belongs also to the finest of our butterflies. It flies from July to September, and deposits its eggs on nettles. The brownish-yellow or blackish caterpillars have yellow or white stripes on their sides, and are covered with yellow, branchy bristles. They live solitary between leaves, which they spin together, and in June change into greyish-brown pupæ with bright spots, from which the familiar butterfly emerges after a few weeks.

The PAINTED LADY (*Vanessa cardui*), Plate X., Fig. 1, flies solitary in the early Spring, but in some years is seen in large numbers in the Summer. It deposits its eggs in thistles. The variegated caterpillars (1 *a*) live solitary between leaves woven together. The greyish-brown pupa (1 *b*) has golden prominences, and hangs free from stems of plants. It produces the butterfly in three weeks.

The SILVER-WASHED FRITILLARY (*Argynnis Paphia*), Plate X., Fig. 2, also called the emperor's mantle, is frequently met with in woods in July and August. The caterpillars (2 *a*) live upon violets, nettles, strawberries, and raspberries; they are brown, with a broad yellow

stripe along the back, which is crossed by a black line. The suspended pupa (2 *b*) is very active; the pupal stage lasts three weeks.

The MELANAGRIA GALATHEA, Plate X., Fig. 3, is very familiar, and flies in the same months and the same places as the above. Its caterpillar lives upon grasses, and changes on the ground into a yellowish pupa.

The SATYRUS HERMIONE, Plate X., Fig. 4, is rare, and flies in July and August. It generally deposits its eggs on honey-grass, upon which the reddish grey, smooth caterpillars are found. These live concealed, and, after going through the Winter, change into a dark-brown pupa, from which the great moth emerges in three weeks.

The DEATH'S-HEAD MOTH (*Acherontia Atropos*), Plate X., Fig. 5, stands, in respect to size, at the head of the European Lepidoptera. It flies in June and in August. Its caterpillar (5 *a*) lives chiefly on the potato plant, and undergoes its change in the earth. The large pupa (5 *b*) is reddish brown, and the large moth generally emerges after four or five weeks. The death's-head moth is rare.

The DEILEPHILA EUPHORBÆ has greyish-yellow fore wings, with olive-green shading in parts, and a rosy tinge; the hind wings are rose red at the base and black near the margins. The butterfly flies in June and July. Its caterpillar lives on the euphorbia, and is dark green with a red stripe on the back, and yellow and red patches on the sides. In August it changes, in the earth, into a greyish-brown pupa, which goes through the winter. This butterfly is common everywhere.

The POPLAR SPHINX (*Smerinthus populi*), Plate X., Fig. 6, flies in May and June, and deposits its eggs on poplars and willows. The caterpillars (6 *a*), which live throughout the summer on these trees, are bluish green



with yellowish-white stripes. They undergo their change in the earth; the pupa (6 *b*) is dark grey with lighter markings.

The PEACOCK MOTH (*Smerinthus ocellata*), Plate X., Fig. 7, is a beautiful moth, which is often met with on blossoms in the evenings of May and June. It lays its eggs on apple trees, poplars, and willows, and its caterpillar (7 *a*) closely resembles those of the moth last mentioned. The brownish-black pupa (7 *b*) also lies in the earth. This moth is common everywhere, and the caterpillar often does damage in schools of horticulture.

The SPHINX (*Macroglossa Stellatarum*), Plate XI., Fig. 1, is a small moth which flies in May, and again from August to October. The greenish or reddish-brown caterpillars live upon the cheese-wort, and change into a brownish-grey pupa, lying between leaves spun together. This moth is common everywhere.

The HUMMING-BIRD MOTH (*Macroglossa bombyliiformis*), Plate XI., Fig. 2, flies in May and June. It loses the scales on its wings at the first flight, so that the latter are clear, like glass. The caterpillars live upon the cheese-wort and honeysuckle, and are greenish, with a curved, red point to the tail. The metamorphosis takes place in an oval, brownish-yellow cocoon.

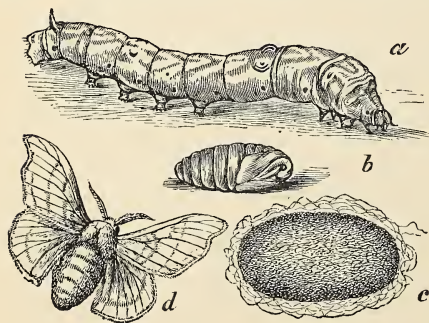
The GYPSY MOTH (*Zygæna filipendulæ*), Plate XI., Fig. 3, is common everywhere, and is especially met with in July and August in the woods, upon blooming thistles, scabious, etc. The caterpillars, which are yellow with black patches on the back, live upon clover, speedwell, plaintain, and St. John's wort, and change, enveloped in a greyish-yellow, paper-like cocoon, into a dark-brown pupa, yellowish on the hind parts.

The TIGER MOTH (*Arctia caja*), Plate XI., Fig. 4,

is a common moth. Its hairy caterpillars live upon various plants (broom, etc.), and feed upon all sorts of vegetable matter. In May or June they are fully developed; and, enveloped in a large cocoon, change into a brown pupa (4 *b*), from which the moth emerges after three to four weeks.

The BLACK ARCHES MOTH (*Bombyx neustria*), Plate XI., Fig. 5, flies in July, and is often seen flying about our windows in the evening. The female deposits three to four hundred eggs in pretty spiral rings round the young shoots of plum and other trees. From these eggs the caterpillars emerge in the following spring. The latter, when full grown, are striped with white, blue, brownish red, and yellow, and covered with fine hairs (4 *a*). They change between leaves into a dark-coloured pupa (4 *b*). The *Bombyx neustria* is rightly classed among the harmful insects, for its caterpillars frequently eat away all the leaves in an orchard. Other moths injurious to fruit trees are the *Ocneria dispar* and the *Porthesia chrysorrhæa*.

The SILK-WORM MOTH (*Bombyx mori*), Plate XI., Fig. 6, originally came from Southern Asia, and is now cultivated in China and Southern Europe for the purpose of obtaining its silk. The female moth deposits in July three to five hundred eggs, from which the white caterpillars (*a*) emerge in the following spring, at the period when the white mulberry tree blooms, upon the leaves



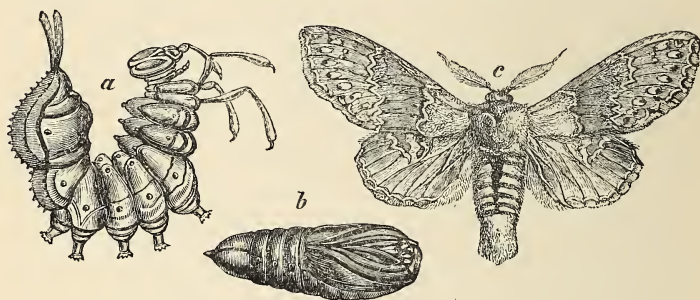
of which they feed. The caterpillars change their skins four times, and are full grown in about a month. They now spin a cocoon (*c*), which is generally completed in three and a half days, and five days later they change into pupæ (*b*). The pupal stage lasts from fourteen to nineteen days. The cocoons furnish the silk, and the pupæ are generally killed on the tenth day by heat. For this purpose they are plunged into boiling water, and beaten with rods in order to loosen the gum binding the threads together; the raw silk surrounding the cocoon is then unwound. The ends of several cocoons are then joined, and five to seven threads twisted together and wound on to reels. The silk thread is about one thousand yards long. Five to six hundred cocoons weigh two pounds, and twenty pounds of cocoons yield two pounds of spun silk. The eggs of the silkworm were first brought to Europe by two Christian monks in 555 A.D., who took them in hollow sticks to Constantinople, whence the cultivation of the silkworm rapidly spread to other parts. The produce of silk has much declined in Europe lately, owing to a destructive disease of the worms. One of these diseases, the muscardine, is caused by a fungus (*Botrytis bassiana*), which develops inside the worm.

The LASIOCAMPA QUERCIFOLIA, Plate XI., Fig. 7, appears in July and August, and deposits its eggs on fruit trees, and on the blackthorn. The grey caterpillars have two dark-blue indentations in the neck. Their metamorphosis takes place in a dark-grey web or cocoon, and the pupa is of a dull black, sprinkled with blue. The caterpillars of this moth are often injurious in schools of arboriculture.

The PINE SPINNER MOTH (*Lasiocampa pini*), Plate XI., Fig. 8, is in some years very common, and does a great

deal of damage in the pine woods. In July or August the female moth deposits from one hundred and fifty to two hundred and fifty eggs on the pines. The caterpillars soon emerge and pass through the winter, attaining their full size in June of the following year. They are grey or brown, and have on the second and third ring a steelish-blue patch. Their change takes place in a thick web, and the pupal stage lasts three weeks.

The *STAUIRUPUS FAGI* has brownish-grey wings. It flies in May and June, and deposits its eggs on the beech,



Stauiropus.

hazel, oak, lime, and alder. The dull light-brown caterpillar (a) is curiously shaped, and immediately falls off the tree. In the autumn it changes into a bright reddish-brown pupa (b), which passes through the winter between the fallen leaves of the trees. The moth, which is rare, appears in the months of May or June.

The PROCESSION MOTH (*Cnethocampa processionea*), Plate XI., Fig. 9, appears in August and September. The female deposits one hundred and fifty to two hundred eggs on the trunks of the oaks, from which the caterpillars emerge in the spring. During the day the latter lie quiet in their webs, but in the evening they crawl up the trees

in troops. Here they feast upon the leaves so greedily as to frequently denude whole trees of their foliage. These caterpillars are not only feared on account of the damage they do to the trees, but also because their very brittle bristles, which are hooked at the ends, cause violent inflammations when they prick the skin of man or animal. They change into a yellowish-brown pupa while enveloped in a dull yellow cocoon.

The AGROTIS PRONUBA, Plate XI., Fig. 10, is a common moth everywhere. It flies in June and July, and its yellowish-grey caterpillars feed upon the sorrel, cowslip, violet, nettle, etc. The metamorphosis takes place in the earth.

The GREEN OWL MOTH (*Moma Orion*), Plate XI., Fig. 11, is also common, and appears in May and June. The caterpillars, which are black with reddish-brown hairs, are found on oak, beech, and birch trees. In October they change between leaves into a reddish-brown pupa, and remain in this state throughout the winter.

The CATOCALA FRAXINI, Plate XI., Fig. 12, is rather rare. The ashy-grey caterpillars live upon the poplar, ash, oak, and beech trees, etc., feeding upon the leaves at night. Their change takes place in a loose web fastened between leaves, and the pupa is sprinkled with blue.

The CATOCALA NUPTA, Plate XI., Fig. 13 will be found in August and September on the trunks of willows. Care must be taken not to overlook it, for when at rest it folds the red hind wings under the greyish-brown fore wings. The caterpillars live upon willows and poplars, and undergo their change in a white cocoon, fastened between leaves, or in a cleft in the bark. The pupa has also beautiful blue markings.

The MAGPIE or CURRANT MOTH (*Abraxas grossulariata*), Plate XI., Fig. 14, is very common, and flies in July and August. Its caterpillars (14 *a*) feed on the leaves of the gooseberry and currant, and strikingly resemble the moth itself in colour. The pupa (14 *b*), which rests in a web fastened between leaves, is brown with yellowish markings. This moth is frequently injurious.

The GREAT WINTER MOTH (*Hibernia defoliaria*), Plate XI., Fig. 15, flies in October and November. The female moth is wingless, and creeps up the tree trunks, where, like the small winter moth (*Cheimatobia Brumata*), it is caught by means of a so-called moth-band. The caterpillars are found not only on fruit trees, but also on almost all other trees. In the summer they undergo their change in the earth.

The CORN MOTH (*Tinea granella*), Plate XI., Fig. 16, belongs, like the following species, to the small moths. It deposits its eggs in June in granaries, where the caterpillars frequently do great injury.

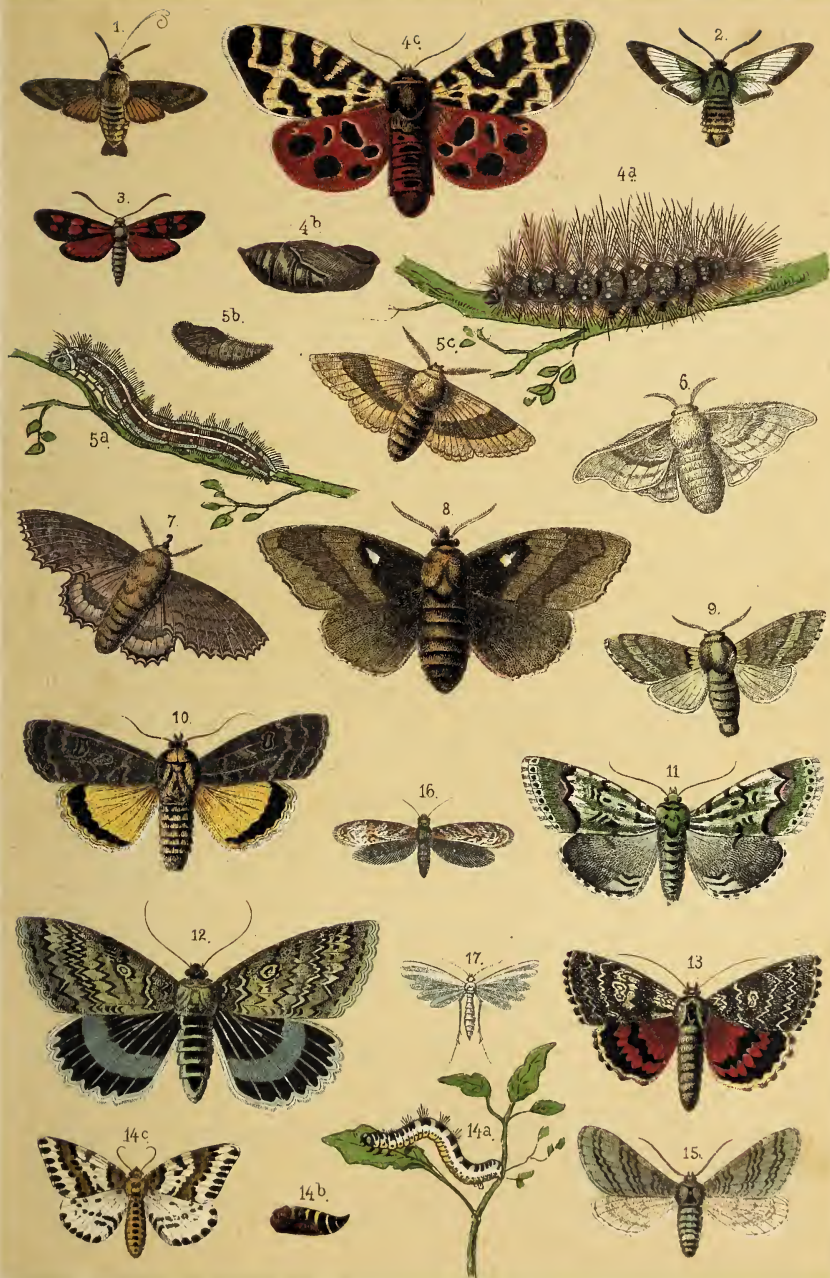
The PTEROPHORUS PENTADACTYLUS, Plate XI., Fig. 17, has its fore and hind wings in sections, and is snow white in colour. It is common from June to August, and its caterpillar lives upon the bind-weed.

As the butterflies and moths can be best studied when cultivated from the caterpillars, we give here a few hints on

Breeding Butterflies and Moths,

followed by some information concerning the capture and preparation of Lepidoptera, and the arrangement of a butterfly collection.

The breeding of butterflies from the eggs is somewhat difficult, and the care of caterpillars demands much



attention, since we must not only study the caterpillars and their habits, but we should also get to know the plants they feed on. First of all, however, we must discover where the caterpillars are to be found. Search must be made in leaves which are devoured in parts, and rolled up in webs, and on old tree trunks, and in flower blossoms and seed capsules ; and collections should be made in the morning and evening, and even at night, with the aid of a lantern ; the caterpillars must be shaken off the trees and plants into an open umbrella, and should be swept off the low bushes in the same way as the beetles. The captured caterpillars should then be placed in the caterpillar cabinet, the bottom of which is covered with two or three inches of earth, mixed with fine sand. The caterpillars should be fed with the same leaves as those upon which they were found. These leaves should be placed in narrow-necked bottles containing water, and renewed as soon as they begin to fade. The caterpillars should be disturbed as little as possible, but may be now and again sprinkled with water, which takes the place of the rain.

When the caterpillars leave off feeding and wander restlessly about, the pupal period has arrived. Some suspend themselves from the twigs of their food plants, others spin a web in the corners of the cabinet, and others again burrow in the earth, where they become pupæ. The pupæ which can be easily removed are now taken out and placed in the pupa cabinet ; the others are left in the positions they have chosen. The pupæ must also be sprinkled from time to time with water, so that they may not dry or produce imperfect butterflies. During the winter the pupæ should be placed where the frost cannot get at them ; but not in a warm room,

which would cause a too rapid development of the butterfly.

If the butterfly emerges from the pupa, we have attained our object; and, having now studied its whole course of development, we may allow it to fly free. But the beautiful airy creatures present so many attractions that their lives are mostly sacrificed in order to adorn the butterfly cabinet. And now the question arises, "How can the butterflies be killed without giving them pain?" In the first place, we must point out that the killing of these creatures is not an occupation for children, and it is much to be regretted that foolish lads hunt the light-winged butterflies with nets, and cruelly kill them. It would be much better if they collected the caterpillars, and bred the butterflies themselves; but they should leave the killing of the insects to their elders, who will do it so quickly that the insects will be saved all unnecessary pain. The thin-bodied day butterflies should be killed by carefully compressing the thorax, but the thick-bodied moths by means of ether, chloroform, or cyanide of potassium.

For mounting the specimens mounting-pins are again necessary. The latter are inserted through the thorax. The specimens are now placed on the mounting board; the wings are spread out and kept in their position by small strips of paper, which are fastened down closely. In order that the wings may lie uniformly, parallel lines are drawn across the board. The specimen can be removed from the mounting board in eight to fourteen days, according to the state of the weather. It is now fastened in the cabinet, and a ticket is stuck beneath it, upon which its name and other particulars are written. The collection must be kept free from dust, damp, and insects.

DIVISION IV.—THE DIPTERA, OR TWO-WINGED INSECTS.

The Diptera or flies have only one pair of wings, for the hind pair are changed into the so-called halteres or balancers. Their mouths are furnished with a sucker. They undergo a complete course of change.

The COMMON GNAT (*Culex pipiens*) deposits its eggs on a leaf, etc., floating on still water. The larvæ here live upon vegetable matter, and, like the water beetles, come to the surface to breathe. The female gnats sting and suck, and worry men and animals by day and by night.

The GAD FLY (*Tabanus bovinus*), Plate XII., Fig. 2, is very common all through the summer. Its larvæ live underground in meadows. Only the female fly sucks the blood of cattle. To this species belong also the wild ichneumon fly, the larvæ of which live in the caterpillars; the grey meat fly (*Sarcophaga carnaria*); the bluebottle (*Musca vomitoria*), which deposits its eggs in meat; the troublesome house fly (*Musca domestica*); the cheese-hopper (*Piophilæ casei*), the larvæ of which live in old cheese; the common flea (*Pulex irritans*), which is known as a clever acrobat, but also as a troublesome pest to man.

DIVISION V.—THE HEMIPTERA, OR BEAKED INSECTS.

The piercing or sucking jaws of these insects form a beak; their wings are partly horny and partly membranous; their course of change is not a complete one.

The COMMON TREE BUG (*Tropicoris rufipes*), Plate XII., Fig. 3, is common everywhere, and is generally found on the trunks of birch trees, and on various plants.

The BED or HOUSE BUG (*Acanthia lectularia*) has gradually spread over all the world. It is a troublesome

parasite of man. The female deposits about fifty white eggs, one millimetre long, in March, May, July, and September, generally in the crevices of bed and sitting rooms, and especially under carpets.

The SCORPION WATER BUG (*Nepa cinerea*), Plate XII., Fig. 4, is somewhat common in the muddy earth of lakes and ditches. It has a sharp sting, and feeds upon other smaller water insects. In the same spots we also find the *Notonecta glauca*, the *Naucoris cimicoides*, and the *Limnobates stagnorum*, *Hydrometra paludum* and *lacustris*.

Of the *Fulgoræ*, which belong to this class, we may mention the Samoan and the Brazilian lantern fly (Plate XII., Fig. 5).

The PLANT LICE live in colonies, feeding upon plants, and some species are extremely injurious. The following are worthy of mention:—The various kinds of leaf lice (*Aphides*), the blood lice (*Schizoneura lanigera*), found on the bark of the apple tree; the phylloxera (*Phylloxera vastatrix*), and the cochineal insect (*Coccus*).

DIVISION VI.—THE NEUROPTERA.

The Neuroptera have four homogeneous, membranous, net-like, veined wings, and mostly biting jaws. Their metamorphosis is a complete course.

THE ANT LION (*Myrmeleon formicarius*).—On Plate XII., Fig. 6, a drawing of the larva is given. It lives chiefly on the edges of woods, in sand, in which it makes a funnel-shaped burrow. At the bottom of this burrow the bold insect lies in wait for insects which fall into the hole, chiefly ants. The change takes place in the cocoon, which is like a ball of sand. The perfect insect closely resembles the dragon fly, as, like the latter, it

has four long somewhat narrow wings to its elongated body.

To this species belong also the May flies (*Phryganea*), the larvæ of which live in the water, and build their dwelling of bits of plants, small stones, and snails' shells, etc.

DIVISION VII.—THE ORTHOPTERA.

The fore wings are either parchment-like or membranous; the hind wings always membranous; they have biting jaws, and their change is a complete course.

The PRAYING MANTIS (*Mantis religiosa*), Plate XII., Fig. 7, inhabits Southern Europe. It is a fierce, voracious insect, which feeds upon other insects, and does not even spare its own race. We may briefly mention here the common earwig (*Forficula auricularia*), common under the bark of trees; the cockroach (*Blatta orientalis*), a common and troublesome insect in houses, especially in bakeries and corn-mills; it is said to have been introduced into Europe from Asia about two hundred years ago.

The MIGRATORY LOCUST (*Pachytylus migratorius*), Plate XII., Fig. 8, is common in Southern Europe, especially in South Russia and Hungary. From here they wander westwards in large troops. Their food consists chiefly of corn, grass, maize, etc., and they deposit their eggs in the earth. Similar to this insect in size is our green leaf locust (*Locusta viridissima*), which is found near corn-fields, living upon shrubs and trees.

The FIELD CRICKET (*Grillus campestris*) is common everywhere; it forms burrows in the earth, and the male sits at the opening to chirp. The larvæ live in the grass. The field cricket is injurious to the garden plants and vegetables. The hearth cricket (*G. domesticus*)

lives in our houses, especially in warm places, and are troublesome on account of their continued chirping. They live upon kitchen refuse.

The MOLE CRICKET (*Grillotalpa Europæa*), Plate XII., Fig. 9, is one of our largest insects. The female deposits in June and July about two hundred eggs in an oval hole in the earth. The larvæ live at first in colonies, but later solitary. Like the perfect insect, they are injurious, since they eat away the young roots, both herbaceous and woody, and loosen the ground.

The DRAGON FLY (*Æschna grandis*), Plate XII., Fig. 10, deposits its eggs in the summer in still waters of lakes and ponds. The voracious and predatory larvæ are elongated, and their lower lip is furnished with a remarkable organ, which enables them to seize their prey with ease, and convey it to the mouth. The perfect insect is a splendid flyer, and feeds upon other insects. In the same localities we find the larvæ of the *Libellula depressa*; and in flowing water those of the *Agrion virgo*.

We may briefly mention here the WHITE ANTS (*Termes*). Their colonies contain males, females, workers, and also soldiers (Plate XII., Fig. 11), the latter undertaking the defence of the colony. Their erections are often twelve to sixteen feet high. The white ants often penetrate into houses, and create much damage by burrowing into the furniture, etc.

CLASS VII.—THE MYRIOPODA.

THEIR bodies consist of the head and abdomen. The former has two antennæ or feelers, and two or three



pairs of jaws ; nearly every ring of the abdomen has one or two pairs of jointed legs.

The COMMON CENTIPEDE (*Julus fallax*), Plate XII., Fig. 15, is familiar everywhere. It lives under stones, moss, and fallen leaves, and feeds upon decayed vegetable matter.

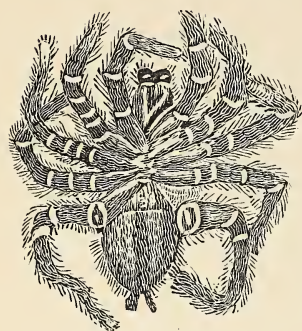
CLASS VIII.—THE ARACHNIDA.

IN this class of insects the head and thorax are joined together in one mass, technically called the cephalothorax, on which they have two pairs of jaws, and four pairs of legs.

The BOOK SCORPION (*Chelifer cancroides*), Plate XII., Fig. 16, attains a length of only three millimetres. It lives, as its name indicates, in books, also in old papers, clothing, and in hen-houses under straw and dry dung. It makes itself useful by the destruction of dust lice and mites.

The EUROPEAN SCORPION (*Euscorpius Europ.*), Plate XII., Fig. 17, is found in Southern Europe, and lives chiefly upon insects and spiders. It has a poisonous sting at the end of the abdomen. Its sting is painful, and sometimes deadly in the non-European species.

The GARDEN SPIDER (*Epeira diademata*), Plate XII., Fig. 18, is common everywhere. It lives in bushes, gardens, and houses, and generally in the neighbourhood of lakes and swamps. Its web is perpendicular, in which it lies in ambush with bent legs. In September or October the female deposits about one hundred yellow eggs, which she carefully watches. The young spiders emerge from the eggs in the following May.



American Spider.

Of all the species of the spider tribe, the GREAT AMERICAN SPIDER is the largest and most terrible. Its back is covered with a hard, thick, brown coat, hollowed at the sides, and cleft transversely across the middle, as if it had a hole in that place; the head is small, and the mouth is furnished with brown, hard, crooked teeth; the body is large and round, growing out in two parts. The whole

body, except the back and the feet, is covered with long, bushy hair.

It preys principally on small birds, surprising them in their nests, tears them to pieces to get at their blood, and afterwards sucks their eggs.

CLASS IX.—THE CRUSTACEA.

THE Crustacea breathe by means of gills, and their bodies consist of rings. They have two pairs of feelers and two pairs of jaws, to which are mostly joined one or more pairs of jaw feet. All the remaining rings of the body may have a pair of limbs each.

The VARIEGATED CRAB (*Grapsus varius*), Plate XII., Fig. 12, inhabits the sea, and is common on all the European coasts. It generally keeps near the surface of the water, but at the least disturbance it disappears in the cracks and holes in the sea-bottom.

The EDIBLE CRAB (*Cancer pagurus*), Plate XII., Fig. 13, is also very common in the European seas. It is, however, found at greater depths than the above, and is eaten as a delicacy.

THE CRAYFISH (*Astacus fluviatilis*), Plate XII., Fig. 14, is found under roots and stones in holes in the banks of rivers and brooks with chalky waters. It has five pairs of front legs and five pairs of back legs; the foremost pair of the former have large claws, but on the two pairs immediately following the claws are small. The crayfish feeds upon decaying animal matter; when this is wanting, it attacks mussels, snails, small fish, and insects. After shedding its shell, the crayfish increases in size, and the so-called "crabs' eyes" which lie in its stomach are used for the formation of the new shell. The crayfish reaches a good age; its flesh is much esteemed, and has the best flavour in those months in which there is no *r*. The lobster, which is somewhat similar to the crayfish, but considerably larger, lives in the North Sea and the Baltic.

CLASS X.—THE WORMS.

THE body is elongated, and in many species divided into homogeneous rings; instead of jointed legs, they have stumpy legs, bristles, or suckers.

To these belong the COMMON EARTH WORM (*Lumbricus terrestris*), common in all gardens and fields; the COMMON LEECH (*Hirudo medicinalis*), which is found in still and flowing waters, and is used for bleeding.

THE TUBE WORM, Plate XII., Fig. 19, belongs to the species *Gephyrea*, and inhabits the sea.

THE TRICHINOSIS (*Trichina spiralis*) lives in the small intestines of man, swine, cats, etc. The larvæ pierce through the intestinal walls, and settle in the muscles, where they bring about very dangerous diseases. They are generally introduced into the human body when raw pork is eaten containing the trichinosis.

THE TAPE WORM (*Tænia saginata*), Plate XII., Figs. 20 and 20a, is from twelve to twenty-six feet long, and often consists of over twelve hundred separate segments. It lives in a developed form in the intestines of man. Its eggs are hatched in the stomachs of cattle.

The tape worm is less dangerous than the trichinosis, and is conveyed into the human body by means of raw beef.

CLASS XI.—THE MOLLUSCS.

THE Molluscs have no limbs. The body is surrounded by a membranous sac, from the secretions of which in many species a chalky shell is formed. As the organs of circulation, digestion, and respiration are well developed, the molluscs have lately been classed higher than the insects.

THE ARGONAUT OR PAPER NAUTILUS (*Argonauta argo*), Plate XII., Fig. 21, has eight arms, furnished with numerous suckers. The sexes differ very much in form, and only the female (Fig. 21) has a shell. The paper nautilus inhabits the Mediterranean.

THE COMMON SEPIA (*Sepia officinalis*), Plate XII., Fig. 22, inhabits the European seas, and feeds upon fish and crabs, for which it lies in ambush near the coasts.

THE LARGE EDIBLE SNAIL (*Helix pomatia*), Plate XIII., Fig. 1, is common in gardens, vineyards, and bushes, especially in chalky districts. In many localities in Europe it is eaten. In autumn it closes the entrance to its dwelling by a covering which it manufactures from its secretions.

THE MASK SNAIL (*Triodopsis personata*), Plate XIII.,

Fig. 2, is found under decayed timber and leaves in the woods, generally in mountainous districts.

The GREAT WATER SNAIL (*Limnæa stagnalis*), Plate XIII., Fig. 3, is common in still waters, and is also kept in aquariums. In the same places we find *Limnæa auricularia*; the common mud snail (*Limnæa vulgaris*); the *Limnæa palustris*, and others; also the large patella (*Planorbis corneus*), and the margined patella (*Planorbis marginatus*).

The VIVIPAROUS MARSH SNAIL (*Paludina vivipara*), Plate XIII., Fig. 4, brings forth living young, the shells of which have four spirals. It is often found in soft, still waters, and is especially suitable for the aquarium.

The STROMBUS has a conical or egg-shaped shell, with plain or indented outer lips. Plate XIII., Fig. 5, shows the narrow strombus.

The MARBLE WHELK (*Conus marmoreus*), Plate XIII., Fig. 6, is common in the tropical Asiatic seas. It feeds chiefly upon other molluscs. The same applies to the ROSENKEGEL, Plate XIII., Fig. 7.

The MITELLA (*Mitra episcopalis*), Plate XIII., Fig. 8, lives in the Indian Ocean.

The SPIDER WHELK (*Muria tenuispina*), Plate XIII., Fig. 9, is also found in the Indian Ocean; it is a predatory animal, and lives upon other molluscs.

The STAIRCASE WENTLETRAP (*Scalaria pretiosa*), Plate XIII., Fig. 10, is a native of the Indian Ocean, and secretes a purple juice. Formerly its shells were so highly valued that one specimen would cost £17. But a shell can now be bought for four to nine shillings.

The COMMON IANTHINA (*Ianthina fragilis*), Plate XIII., Fig. 11, is found in the Atlantic and Mediterranean. It

has attached to its foot a bladder-like secretion called the Floss. The eggs are fastened to the under side of this secretion.

The HALIOTIS (*Haliotis*) inhabits the shallow waters of the Indian and Australian coasts. Fig. 12, Plate XIII., shows the warty haliotis.

The SEA HARES (*Aplyia*) are inhabitants of the warmer seas, and live upon animal and vegetable matter, and when disturbed secrete a purple fluid. Fig. 13, Plate XIII., shows the spotted sea hare.

The COMMON PHOLAS (*Pholas dactylus*), Plate XIII., Fig. 14, is found in all European seas, and bores passages in wood and stone.

The STRIPED SUN SHELL FISH (*Tellina radiata*), Plate XIII., Fig. 15, is found in the Atlantic. It burrows in the sand and mud, and at ebb tide is dug out and eaten. Of European species we may mention the river mussel (*Unio*), the pearl mussel (*U. margaritifera*), and the common pond mussel (*Anodon*).

The EDIBLE LIMPET (*Mytilus edulis*), Plate XIII., Fig. 16, is found in large numbers on nearly all the European coasts. It is eaten boiled, roasted, and pickled.

The GREAT SCALLOP (*Pecten maximus*), Plate XIII., Fig. 17, attains a considerable size. It is also found in all European seas, and is eaten. An important and favourite mollusc of the connoisseurs is the oyster (*Ostrea edulis*), which is found on most European coasts. As it multiplies rapidly, it is bred in oyster beds, from which it is fished up and sent to all parts.

CLASS XII.—THE RADIATA.

THE Radiata are inhabitants of the sea, and their bodies



are starlike in form. The skin secretes chalk, which, sometimes, forms in isolated parts of the body; at others, covers the whole surface of the body with a shell.

The SEA URCHIN (*Heterocentrotus mammillatus*), Plate XIII., Fig. 18, lives in the Indian Ocean and the Red Sea, and wanders through the Suez Canal into the Mediterranean.

The OPHIURA have a roundish body-plate, from which five arms stretch out starwise (Plate XIII., Fig. 19). To this species belongs also the star fish.

CLASS XIII.—THE POLYPS.

THE Polyps, also called animal-plants, are generally found in colonies. The body of the individual animal is nothing more than a cell, the entrance to which is surrounded by tentacles used in catching prey. Their skin secretes a chalky or horny matter, from which the dwellings of these animals are built.

The PHYSALIS (*Physophora hydrostatica*), Plate XIII., Fig. 20, is found in the Mediterranean and Atlantic, and swims upright in the water. Above floats the air sac, which is followed by seven to eleven swimming bladders, then come the rose-coloured cilia, and at the end the long, thin tentacles, armed with stinging tentacles at their ends, with which they seize their prey. The Corals are chiefly found in the shallow, chalky waters of the Torrid Zone. Their bodies consist of a chalky skeleton of great strength. By the gradual increase of their colonies, reefs are frequently formed near islands; sometimes, islands are formed in the open sea, which often obstruct navigation. Plate XIII., Fig. 21, is the madreporé coral;

Fig. 22, the red coral, the ramifications of which are rose coloured, while the insects themselves are milk white; the red or rose-coloured coral is manufactured into various ornaments. Plate XIII., Fig. 23, is the Red Sertularia; Fig. 24 is the *Sertularia filicula*, which is found under duck-weed. The sponge is also nothing less than the habitation of a polypous animal.

CLASS XIV.—INFUSORIA.

THESE most simple and most imperfect of all animals live, almost all of them, in water, and are so small that they cannot be seen with the naked eye. Their bodies are a soft mass, which expands and contracts. They are found in millions in still waters in which vegetable matters are decaying, but they are never seen in spring water, or in the clear water of brooks and rivers. On Plate XIII., Figs. 25-28, are shown various forms of Infusoria.

THE VEGETABLE KINGDOM.

I.—THE FRUIT TREES.

THE fruit trees are cultivated for the sake of their fruit. They bear either *kernel fruit*, when their seed kernels are enclosed in cores of parchment-like formation ; or *stone fruit*, when the seed kernel is enclosed in a hard shell, which is in its turn enclosed in some succulent pulp ; or *shell fruit*, when the fleshy interior is enclosed in a hard shell.



The APPLE TREE (*Pyrus Malus*), Fig. 1, grows wild in forests, but it is found artificially improved everywhere in gardens and orchards. Its bark is generally smooth ; its wood somewhat soft ; its leaves oval-shaped and about double the length of their stalks ; its blossoms are white with reddish margins. Fruit horticulture has produced many species of apples in the course of time.



The PEAR TREE (*Pyrus communis*), Fig. 2, attains a greater height than the apple tree, and has a more pyramidical crown. Its wood is hard, and therefore

much used in joinery and cabinet work. Its bark is generally rough; its leaves are oval or lancet-shaped, slightly serrated, and of the same length as their stalks; its blossoms are white. There are numerous varieties of pears.

Apples and pears are put to many different uses. Many of them are made into cider and perry, while the rest are consumed either raw or in a dried state, or in the form of jam.



To the kernel fruit trees belong also the quince tree, the lemon, and the orange tree. The two latter are natives of Southern Europe.

The CHERRY TREE (*Prunus avium*), Fig. 3, is a stately tree of from twenty-six to forty-five feet in height. It has a pyramidal crown; its smooth bark splits crosswise; its leaves are elliptical, doubly serrated, and covered with down on their lower sides; its blossoms are snowy white and umbelliferous; its fruit sweet and of different colours. The latter furnish an agreeable nourishment, whether consumed raw, boiled, or preserved. Cherry-brandy is also made from them. Closely related to the cherry tree are the Agriot cherry tree (*Pr. Cerasus*), the Rock Agriot cherry tree (*Pr. Mahaleb*), and the common bird cherry (*Pr. Padus*).



THE PLUM TREE (*Prunus insititia*), Fig. 4.—Its height is from sixteen to twenty feet; its leaves are broad, elliptical, and serrated; its

blossoms white ; and the fruit black, red, or yellow, and globular.

The DAMSON TREE (*Pr. domestica*) has, in distinction from the plum tree, oblong-shaped fruit ; it is also frequently cultivated in gardens, and blossoms a little later than the plum tree. The damsons are much used for the manufacture of a superior brandy. There are a great many varieties of plums, differing in colour, shape, and flavour.

The APRICOT (*Prunus Armeniaca*), Fig. 5, comes from Armenia. The tree attains a height of thirteen to sixteen feet, and shows its blossoms in the months of March and April. Its smooth leaves are oval, doubly serrated ; and its white blossoms have a tinge of red. Its globular, velvet-like, downy fruits are a favourite dish for dessert.



In vineyards and in gardens we frequently find the PEACH TREE (*Persica vulgaris*), the beautiful red blossoms of which appear even before those of the apricot tree.

The WALNUT TREE (*Juglans regia*), Fig. 6, attains a height of thirty-six to forty-eight feet. Its crown is wide, its bark ashy grey, its leaves pennate. Its blossoms make their appearance before the leaves ; those which contain only stamens appear in the form of long, loose catkins (Fig. 6a) ; those of its blossoms which have only pistils



are found at the end of the branches in clusters of twos

and fours. The stamens, or male blossoms, fall off; from the female blossoms the well-known nuts are formed, which are a favourite fruit of many people. When gilded, these nuts are also used for decorating the Christmas tree. Its leaves and the green outside husks of the nut are also made use of for medicinal purposes. The wood of the walnut tree is highly valued.

The HAZEL TREE (*Corylus Avellana*), Fig. 7, appears very rarely as a tree; but in the form of a shrub it is frequently seen in forests, and along hedges and in gardens. Its leaves are heart-shaped, and differently serrated. Its blossoms are either male or female. The male blossoms form slender yellowish catkins (Fig. 7a); the female blossoms are hidden in a bud, out of which the purple pistils are seen projecting. The nuts are enclosed in a cup-shaped husk.



The wood of the hazel shrub is used chiefly for making hoops; its fruits are eaten raw, and a savoury oil is expressed from them.

II.—THE FOREST TREES.

THE forest trees are divided into two groups: *Trees Bearing Foliage*, and *Trees with Aciculous Leaves*. The former lose their leaves in autumn; the stiff linear leaves of the latter, on the contrary, live throughout the winter, with the exception of those of the larch tree.

The OAK TREE (*Quercus*) is a true giant amongst the

forest trees. Its trunk often attains a circumference of thirty feet. Its bark is smooth in the young trees and rough in the old oaks. The strong, widely extended boughs are pronged and knotty (gnarled); the crown is large, with a sinuate outline. Two different species of oaks are found: the SUMMER or PEDUNCULATE OAK (*Qu. pedunculata*), Fig. 8, with very short leaf-stalks and long peduncles; and the HOLM or WINTER OAK (*Qu. Robur*), with rather long leaf-stalk and short peduncles. The male blossoms are, in both species, within long pendent catkins; but the female blossoms of the summer oak are attached to long peduncles growing out of the points of young shoots, whilst those of the winter oak are at the bases of the leaves. The oaks blossom in the month of May. The bark and the acorns, which are contained in pretty little cups, are medicinal. Along the stems and the boughs mosses and lichens grow exuberantly. In the galls of the leaves and branches different gall insects live. The horn beetles suck the sap of the oaks, and the acorns form the food of squirrels and other rodents. The wood of the oak is highly useful for all purposes. The bark is used for tanning. The oak stands unshaken in gale and thunderstorm. It takes more than two hundred years before it is fully grown, and may attain an age of five hundred years. But at last the proud, unbending tree will be shattered by lightning, or broken by a strong gust of wind, provided it has not been felled before by the hand of man.



The BEECH TREE (*Fagus silvatica*), Fig. 9, grows on the slopes of narrow valleys, which it transforms into

natural arches ; at our feet we see the brownish soil, formed of innumerable withered leaves ; round us the smooth, silver-grey trunks as columns ; above us bright, rounded tree-crowns, through which the clear-blue sky is hardly visible. The egg-shaped leaves are like leather ; the male blossoms are at the base of the leaves, the female blossoms at the point of the young shoots ; the beech-nuts are three-cornered ; they grow in couples in a wooden capsule. The beech trees attain a height of from sixty to ninety feet, and blossom in April and May.

The HORNBEAM (*Carpinus Betulus*) has generally a twisted stem, and thin, erect boughs.

The WHITE BIRCH TREE (*Betula alba*), Fig. 10., is known by all on account of its chalk-white bark, and its fine, pendent leaves. The male and female blossoms of this tree also grow separate on the same plant. Its seeds are small and plumed, whereby they are particularly adapted for being sown by the aid of the wind.

The LIME TREE (*Tilia*) is the emblem of intense feeling. It has been from time immemorial the favourite of the Germans. Below the large lime trees the judicial proceedings, the fairs, and national games formerly took place in Germany, and to this day men and women like to sit under the village lime tree, and talk of the good old times. The lime trees do not blossom before June and July. At each peduncle is a greenish-yellow bract. The blossom itself



is five-leaved, and contains many stamens and one pistil. The fruit is a little nut.

The SMALL-LEAVED LIME TREE (*T. parvifolia*), Fig. 11, has in the corners of the leaf-ribs on their lower sides little brown beards, and three to twelve blossoms in one umbel; but in the large-leaved lime tree the rib-beards are white, and the leaves and blossoms somewhat large. The dried blossoms of the lime tree furnish a medicinal tea.



The MOUNTAIN MAPLE TREE (*Acer Pseudo-platanus*), Fig. 12, blossoms in May.



Its stem is straight. The greyish-brown bark of the old tree is rough, its large leaves five-lobed; its light-green blossoms stand in long, hanging clusters; its fruit is a winged double fruit. Height of the maple tree, forty - five to eighty feet.

The ASH TREE (*Fraxinus excelsior*), Fig. 13, has a grey, slightly rough bark. Its leaves are pennate, and its small blossoms (Fig. 13a) appear, already before the leaves, in April and May; its fruit is also pennate. The ash tree grows from ninety to one hundred and five feet high. Its yellowish-white, tough wood is much valued.

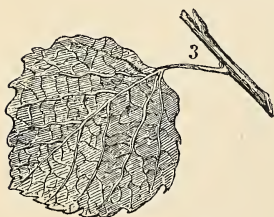
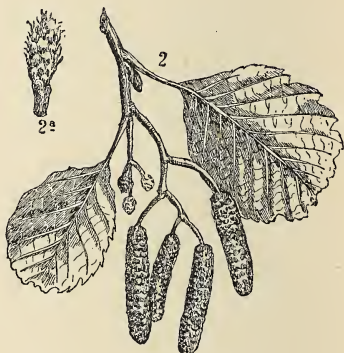


The ELM TREES (*Ulmus*) attain a height of forty-five to eighty-four feet. They blossom before their leaves



appear in March and April. With the COMMON ELM TREE (*U. campestris*) the blossoms stand in clusters on short stalks; but with the WYCH ELM (*U. montana*), Fig. 1, the blossoms are long-stalked. The fruit is roundish and enveloped in a winged skin.

The BLACK ALDER TREE (*Alnus glutinosa*), Fig. 2, grows near the brooks. The male blossoms stand in long, cylindrical catkins; the female blossoms in small roundish catkins (Fig. 2a). The fruit is found in small cones. The alder tree blossoms in April and May; its wood is light and hard, and is used for hydraulic structures.



The GREY ALDER TREE (*A. incana*) grows in mountainous forests.

The ASPEN, or TREMBLING POPLAR (*Populus tremula*), Fig. 3, has a greenish-grey bark. Its leaves have long stalks, and tremble at the slightest current of air.

The male and female blossoms stand in longish catkins, but are distributed in such a manner that some trees have only blossoms with stamens, some blossoms with pistils only. Therefore the trembling poplar is called diœcious. The alder, birch, oak, and beech trees are monœcious; the lime, elm trees, and some other trees have hermaphrodite blossoms. The trembling poplar grows thirty-six to sixty feet high, and blossoms already in March and April, before its leaves have appeared.

In pleasure-grounds we find the WHITE POPLAR TREE (*P. alba*), with leaves which on their under sides are like white felt, and have three to five lobes; and the BLACK POPLAR TREE (*P. nigra*), the buds of which are useful to the apothecary. The PYRAMIDICAL or ITALIAN POPLAR TREE (*P. pyramidalis*), with very upright boughs, frequently grows along the roadside.

The SALLOW ROUND-LEAVED WILLOW (*Salix Caprea*), Fig. 4, is also diœcious, and grows nineteen to thirty feet high in forests and along the waterside.

Its leaves are egg-shaped and wrinkled; the male blossom catkins (Fig. 4 *a*) are yellow, those of the female blossom greenish. They possess great quantities

of honey, and attract therefore all kinds of insects, especially hive bees and humble bees. The pollen of the male blossoms remains sticking to the bees'



hairy bodies, and is then carried by them to the female blossoms.

In many plants the stamens and pistils stand close together, and then *self-fertilisation* is possible. In other plants which have a quantity of pollen, the latter is carried by the wind to the pistils. But in the case of the willows and many other plants there are particular insects required for the purpose of fertilisation, which are rewarded for their services with the existing honey. The Sallow Willow blossoms in March and April. The fruit is shown open in Fig. 4 *b*. Along the banks of rivers is also found the WHITE or SILVER WILLOW (*S. alba*), and many other plants belonging to this family of willows. The greater part, however, grow in the form of shrubs, the thin branches of which are chiefly used for basket-making.

The WEEPING WILLOW (*S. Babylonica*) grows over graves.

The HORSE CHESTNUT TREE (*Æsculus Hippocastanum*), Fig. 5, is rarely found in forests, but frequently in pleasure-gardens. This beautiful tree, of a height of sixty feet and over, has large leaves, and splendid yellow-and-red coloured blossoms forming large pods. The brown chestnuts are enveloped by a prickly cover, which bursts open in the autumn. The horse chestnut tree was brought to Europe from Asia about three hundred years ago.



The CHESTNUT TREE (*Castanea vulgaris*) has lancet-like, indented leaves and edible fruit. We also frequently find in gardens the PLANE TREE (*Platanus*), which sheds its bark in the form of scales.

The SILVER FIR or WHITE FIR TREE (*Abies pectinata*), Fig. 6, inhabits the mountainous forests of Germany. It reaches ninety to one hundred and thirty feet in height, and has a smooth, light silver-grey bark, and needle-shaped leaves, which, although they stand singly and in a spiral form round the branches, are yet distinctly turned towards two sides, and are serrated at their points. The large, conical fruits stand like tapers upright on the branches, and decay upon the tree; whilst their spindles remain standing. Their seeds are pennate, like those of most trees with acicular leaves. The wood of the white fir tree is much valued. It is used as timber, and in particular for making masts; it is also useful for making all kind of carved work, and for the manufacture of musical instruments. Fig. 6, shows a branch with a female blossom catkin; Fig. 6a, a male blossom catkin.



The SPRUCE FIR (*Picea excelsa*), Fig. 7, also called Red Fir Tree, on account of its reddish-brown bark.

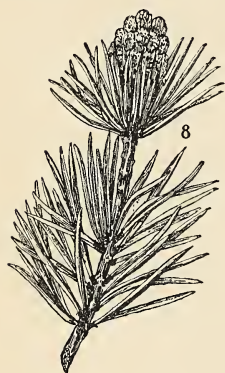


Its boughs are turned downwards; its sharp-pointed, almost quadrangular, acicular leaves stand in a spiral form round the branches. Its male and female blossoms are separate, and stand in catkins. The large cones are without stalks, and lie close to the twigs. The pine tree grows to a height of from eighty to

one hundred and twenty feet. Its bark is used for

tanning, and when excoriated it supplies resin, from which pitch and turpentine is made, and which is also employed in apothecaries' shops. Its wood is used as timber and firewood, and for the work of joiners, turners, etc. The young tree is preferred to any other trees for Christmas trees, and is then magnificently decorated with gilt nuts, apples, tapers, and ornaments.

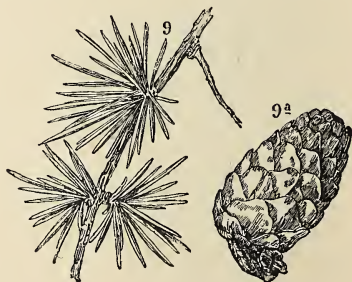
The SCOTCH PINE, the German "Kiefer" (*Pinus silvestris*), Fig. 8, has acicular leaves of the length of



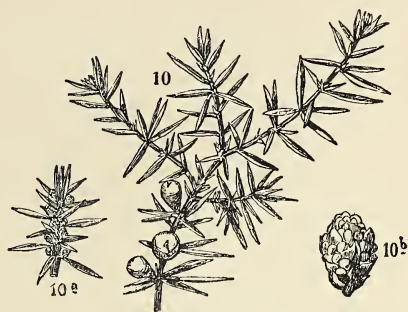
about one and a half inches, which always grow in pairs, and are enclosed at their bases in a skin-like sheath. The male blossom catkins stand on the young shoots; above them at the points are the female blossoms, which are united into small reddish catkins. The fruit of this tree is conical, and about one and a half inches long; its stalk is bent backwards. The height of the pine is from sixty to one hundred feet.

It thrives even in a barren, sandy soil, and has a great many dangerous enemies amongst the insects.

The LARCH TREE (*Larix Europæa*), Fig. 9, has acicular leaves, which grow in clusters, and drop during the Autumn. Its bark is rough and cracked; its female red-blossom catkins stand at the side of the yellow male catkins. Its egg-shaped little cones (9a) have backward bent stalks. The larch tree attains a height of from forty-five to sixty feet, and is found in forests everywhere.



The JUNIPER TREE (*Juniperus communis*), Fig. 10, is rarely seen as a tree, but appears usually as a low shrub. Its awl-shaped, pointed leaves stand always by threes of the same height on the young shoots. The male blossom catkins (10a and 10b) are short-stalked, and standing singly in the axils of the bracts; the fruit is a black berry.



These berries are employed for medicinal purposes.

We may also mention the YEW TREE (*Taxus baccata*); the WEYMOUTH PINE (*Pinus Strobus*); the THUJA or TREE OF LIFE (*Thuja*); the CYPRESS (*Cupressus sempervirens*): the latter is frequently found in cemeteries.

THE TREES IN WINTER.

Whoever interests himself in the winter with trees and shrubs when they have lost their foliage, will soon find that they may even in that season easily be recognised by a little branch with its few buds. For in the position and the construction of the latter a great conformity to natural laws is discernible. Out of a tree-bud arises either a blossom or a cluster of blossoms or a foliate shoot. The spur of a fallen leaf, on the axil of which the bud was standing, is called the stigma of the petiole; the elevation (protuberance) upon which the latter is frequently seen is called the node. According to the position of the buds on the twigs the buds are divided into end and side buds, according to their contents into

blossom, fruit, and leaf buds. There is a great variety of buds, classed not only according to their position, but



Fig. A.

also as to their colour and envelopes. In the ash tree (Fig. A, 1), the common maple, and the Norway maple (Fig. A, 2 and 3), the buds are opposite to each other; in the elm trees (Fig. A, 8 and 9), alternate and double-rowed; in the willow trees (Fig. A, 4), in a spiral direction. The same arrangement can be observed with the sheaths in which the buds are enveloped. Even the number of the sheaths is very different: most species of the willow tree have only one; in the bud of the lime tree, two; in the buds of the birch tree, three; in those of the ash tree, four; six to eight in the maple buds; ten and more in those of the oak tree.

The ash tree (Fig. A, 1) has velvet-like, black, short, conical buds; the stigma of the leaf stalk is large, and the venation of its vascular bundles form a $\cup$. With the mountain maple tree (Fig. A, 2) the buds are light green and egg-shaped; the terminal bud is much larger, and the side buds form, with the branch, the fourth part of a right angle. The buds of the pointed maple tree (Fig. A, 3) are reddish brown and rather small, and its side buds are close to the branch. The willows

(Fig. A, 4) have small hood-shaped buds, the slit of which is turned towards the branch. The lime (Fig. A, 5) has double buds of different sizes. The hornbeam (Fig. A, 6) is without a terminal bud; its buds stand perpendicular above the stigma of the leaf stalk, are longish, scantily furnished with hairs, and lie round the branch in a spiral direction. The buds of the black poplar (Fig. A, 7) are conical and very pointed; the terminal bud is much larger than the side buds. With the elm trees the conical buds stand obliquely above the stigma of the leaf stalk; in the common elm (Fig. A, 8) they are more roundish, lying closer to the branch, hairy, and coffee-brown; with the weeping-elm (Fig. A, 9) they are pointed, bare, and light cinnamon-brown. The beech tree (Fig. A, 10) has long buds, which project out from the branches. In the oak (Fig. A, 11) the terminal bud is larger than the other; close to it lie several side buds.

III.—SHRUBS.

THE plants mentioned above are woody plants with only one stem, which begin to form branches at some distance from the ground. The shrubs, on the contrary, are woody plants in which the stem forms branches close to the ground, or even underground.

The VINE (*Vitis vinifera*), Fig. A, 1, has a climbing, knotty trunk, which attains a length of thirty to fifty feet; its leaves have from three to five lobes, and are coarsely serrated; its small fragrant greenish blossoms stand in panicles. The fruit of the many varieties of vine, which have been produced by cultivation in the course of thousands of years is very different in colour, size,

and flavour. It is either consumed raw and dried, or manufactured into wine. Well known are the Malmsey, the Muscadine, the Burgundy, and the Chasselas wines. Celebrated wines are Rhine wine, the Moselle wine, the wines of Southern France and Champagne, and the Spanish, Greek, Italian, and Hungarian wines. Since the year 1863 the *Phylloxera vastatrix*, which was imported from America, has done incalculable damage to the vines



Fig. A.

of Europe, especially in the French vineyards. This apterous insect (Fig. B, *a*) bores into the little tender roots, and sucks out the sap; thence knotty swellings (Fig. B, to the right) are formed, which after some time rot and cause the decay of the vine. The winged phylloxera (Fig. B, *b*) appears in the autumn, between August and October, and deposits the eggs. Out of these eggs male and female insects emerge, which are without mouths and wings. Each of the females then lays one larger egg, the so-called winter egg, out of which in the following spring the apterous insects again come forth. These begin to suck the roots of the vine, and multiply to an incredible extent in a very short time. The damage done by these insects in French vineyards alone has been estimated at five thousand millions of francs.

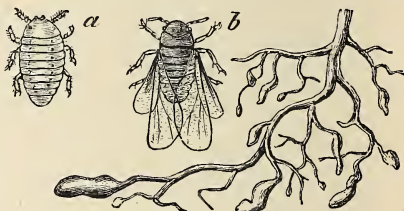


Fig. B.

The GOOSEBERRY BUSH (*Ribes Grossularia*), Fig. C, 2,

has branches covered with spines, brown-reddish blossoms (2 *a*) and berries (2 *b*) of green, yellow, or reddish colour, which stand singly on the young shoots. It is frequently planted in gardens, and has many varieties. It is consumed raw and preserved.



Fig. C.

THE CURRANT BUSH (*Ribes rubrum*), Fig. D, 3.—Its branches are not prickly; its leaves have three to five lobes, greenish-yellow blossoms (3 *a*), and black, red, or white berries (3 *b*), which hang in clusters like grapes. It is often planted in gardens for the sake of its savoury fruit, but is also found in a wild state. From gooseberries and currants a good wine can be made.



Fig. D.

The RASPBERRY BUSH (*Rubus Idæus*), Fig. E, 4, grows frequently in woods, but several of its varieties are also cultivated in gardens. The berries (4 *a*) are consumed raw or in a preserved state, or are manufactured into raspberry juice, wine, and cordial.



Fig. E.

The BILBERRY TREE (*Vaccinium Myrtillus*), Fig. F, 5, is most frequently found in pine forests, but is also met with in woods. It is from eight to twenty inches in height, and has egg-shaped, serrated leaves, with round blossoms lightly tinged with red. The black berries are used for medicinal

purposes; they are also eaten raw, and when dried are used for colouring wine. Bilberries are also made into jam and used for flavouring cakes. A liqueur is manufactured from these berries.



Fig. F.

The BLACK ELDER TREE (*Sambucus nigra*), Fig. G, 6, grows frequently in bushes and hedges, and along walls. It is about sixteen feet high, and has large pennate leaves with a disagreeable smell. It bears its small white blossoms (6 a) in large flat umbels. Its fruit (6 b) is a black berry. The elder blossoms are used by apothecaries; elder tea, when taken for a cold, causes perspiration.



Fig. G.

The SLOE or BLACKTHORN (*Prunus spinosa*), Fig. H, 7, has thorny branches, elliptical serrated leaves, and single white blossoms, which grow in such numbers that they sometimes resemble snow. Its fruit (7 a) is black and blue. It grows from three to six feet high in copses, hedges, and forests.



Fig. H.

The WHITETHORN or HAWTHORN (*Crataegus Oxyacantha*) has a light grey bark, and branches, which end, like those of the preceding shrub, in a thorn. The three to five lobed leaves are doubly serrated. Its blossoms are white with red pistils; its fruit is of a deep red, and belongs to the stone fruits. It is common amongst the hedges, and along the borders of woods.

The BARBERRY SHRUB (*Berberis vulgaris*), Plate XIV., Fig. I, has fascicular and crooked, egg-shaped leaves, at the base of which are one to three partite thorns, which may be taken for stunted leaves. The yellow blossoms, which have a strong smell, form grape-like pendent clusters; the longish berries are scarlet. The barberry grows, three to six feet high, in hedges and underwood.



Fig. I.

The PRIVET (*Ligustrum vulgare*), Fig. I, 8, is common in hedges, underwood, and forests. It is from three to ten feet high, and has egg-shaped leaves and white blossoms in a panicle with two stamens and one pistil. The fruit is a black berry (8 a).

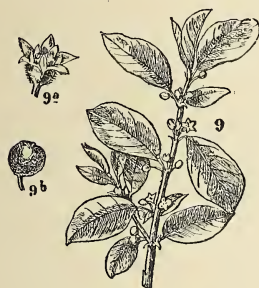


Fig. J.

The BERRY-BEARING ALDER or COMMON BIRD-CHERRY TREE (*Rhamnus Frangula*), Fig. J, 9, has egg-shaped entire leaves and small greenish-white blossoms (9 a), which stand in the axils of the leaves. The black fruit (9 b) is of the size of

a pea. This shrub grows nine to twelve feet high, and is found in great numbers in forests. Its bark has medicinal qualities.

The SPINDLE TREE (*Evonymus Europæus*), Fig. K, 10, grows in hedges, underwood, and forests; blossoms in May and June; and grows three to nine feet high. Its branches are quadrangular; its leaves oval; its tiny

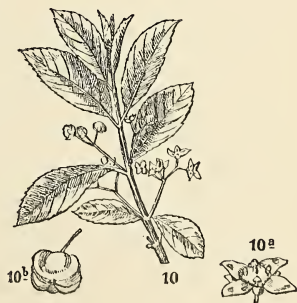


Fig. K.

blossoms (10 *a*) whitish green. Its fruit (10 *b*) is a quadrangular purple capsule.

The DOG-WOOD (*Cornus sanguinea*) has white blossoms which stand in umbels, and black stone fruit.

The CORNEL TREE (*C. mas*) has yellow blossoms and red edible stone fruit. Both these shrubs grow in hedges, underwood, and gardens: the former blossoms in May and June; the latter in March and April. The wood of the dog-wood is very hard.

The SYRINGA or LILAC (*Syringa vulgaris*), Fig. L, 11, is an ornamental plant found nearly everywhere, which opens its clusters of white or violet fragrant blossoms (11 *a*) already in May.



Fig. L.

The WILD ROSE (*Rosa canina*), Fig. M, 12, is covered with bent thorns; its leaves are pennate; its blossoms have a beautiful pink corolla; its fruits are lodged in the red fleshy calycle (calix) (12 *a* and *b*). This shrub blossoms in June and July, and is found in hedges and underwood. From it descends the garden rose, the "Queen of Flowers," with its delicious perfume. Its numerous varieties, with colours of all kinds, are the chief ornament of the flower garden.

We may also mention here the WOOD-BINE or HONEYSUCKLE (*Lonicera Periclymenum*) of the hedges and underwood; the CLIMBING IVY (*Hedera Helix*), growing along walls and up trees; the WATER ELDER.



Fig. M.

with its white blossoms (*Viburnum Opulus*), found in forest and underwood ; the slender CLEMATIS or VIRGIN'S BOWER (*Clematis Vitalba*) found in hedges, underwood, and along forest borders.

IV.—EXOTIC TREES AND SHRUBS.

THE SUGAR PALM TREE (*Arenga saccharifera*), Fig. N, is a true vine palm. It grows in the Sunda Islands. The blossoms furnish a wholesome wine. From its pith a sort of flour is prepared ; its fruit is very acrid, and when eaten causes the lips to swell. The PALM TREES have generally straight scaly trunks without boughs, and, many species attain a considerable height. Their large pennate or fan-shaped leaves grow near the top, and form a beautiful crown. The numerous blossoms stand in long panicles. The palm trees inhabit the Torrid Zones ; they represent the only riches of many tribes of mankind, providing them with food, drink, dress, and building materials for their dwellings. The most valued are the cocoanut, date, and sago palm trees. The large nuts of the first named are the well-known cocoanuts.

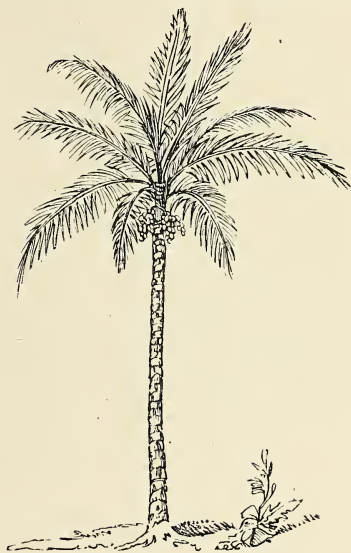


Fig. N.

The PEPPER PLANT (*Piper nigrum*), Plate XIV., Fig. 2, is found all over the Torrid Zone, and is an important article of commerce in the East Indies. Its berries

stand to the number of twenty to thirty on one spike ; at first they are green, then they turn red, and finally black. The black pepper is prepared from the unripe fruit, the white from the ripe fruit, which loses its black shell by being put into salt water (sea water). Pepper is now an almost indispensable condiment.

The CLOVE TREE (*Eugenia caryophyllata*), Plate XIV., Fig. 3, grows chiefly on the Moluccas. It belongs to the evergreen plants. Its milk-white blossoms have a blood-red calyx. They are collected before they are in full bloom, laid on hurdles, and smoked by means of a gentle wood fire, whereby they obtain their brown colour. The cloves are used as spices and for the preparation of liquors, and as medicine.

The COFFEE TREE (*Coffea Arabica*), Plate XIV., Fig. 4, originally a native of Africa, is now chiefly cultivated in the East and West Indies. It attains a height of twenty-four to thirty feet. It is generally, however, kept at a much inferior height, in order to facilitate the collection of the fruit. Its leaves are evergreen ; its blossoms white and fragrant. The fruit is a red berry of the size of a cherry, which contains two kernels, lying closely side by side : the coffee beans. These coffee beans are used everywhere for the preparation of that coffee which has become an indispensable beverage for many millions of people.

The total produce of the coffee plantations amounts yearly to above one thousand millions of pounds. Of these about five hundred millions of pounds are consumed in Europe ; and about three hundred and fifty millions of pounds in North America. Coffee was introduced into England in 1652.

The CHINESE TEA PLANT (*Thea Chinensis*), Plate XIV.,



Fig 5, grows chiefly in China and Japan. It is rarely allowed to grow above three feet. From its white scentless blossoms there develops a roundish fruit of the size of a plum, which contains two to three seeds of the size of cherry stones. But the plant is not cultivated for the fruit, from which a good oil is expressed, but for its short-stalked oval leaves, from which the tea is prepared.

The latter are collected several times in the course of the year, roasted and rolled, and then dried and most carefully packed. They are then sent to all parts of the world. The tea, which is prepared from the most tender leaves, collected in February and March, is called in China the imperial or bloom tea. Its great expense has precluded it from becoming an article of commerce, and it is only sent to the Imperial Court. Tea and coffee contain no nutritious matter, and are only stimulants.

The BREAD-FRUIT TREE (*Artocarpus incisa*), Plate XIV., Fig. 6, grows upon the islands of the Pacific Ocean, and has also been transplanted to those parts of America which lie in the Torrid Zone. It attains a very great height, and bears fruits weighing from three to four pounds. The latter are cut into slices, and after being dried and roasted are used as food. These fruits, when pounded and mixed with the milk of the cocoanut, form a dough, which is either consumed raw or baked into bread. All parts of this tree are useful; its yellow wood is used for the construction of houses, from its fibres articles of clothing are made, and its sap is used for making bird-lime. Its large leaves serve as tablecloths and napkins, and its blossom catkins when dried are an excellent tinder. The bread-fruit tree is therefore much cultivated. It has been stated that three trees will furnish sufficient food for an adult all the year round.

V.—KITCHEN VEGETABLES.

THE POTATO (*Solanum tuberosum*) is the greatest gift America has sent us. Its cabbage-like stalks have a height of from eighteen to twenty inches; its leaves are solitary and pennate; its large pentagonal blossoms are white, reddish, or violet; its fruit is a green berry. Attached to its underground runners are those bulbs which serve as food to many millions of people, and from which starch, sago, sugar of grapes and brandy are prepared.

At first the potato was received with reluctance, and it was not before the end of the eighteenth century that its cultivation became general. In the course of the last forty years the cultivation of this plant has in some countries been much injured by the potato disease,



Fig. O.

which is caused by a fungus (*Peronospora infestans*), and great was the alarm of agriculturalists when the POTATO or COLORADO BEETLE (Fig. O) made its appearance. These beetles and their larvæ feed on

the stalks of the potatoes, and since the year 1860 they have often destroyed the whole harvest in many districts of North America.

Of the different varieties of CABBAGE which are

cultivated in our gardens we will only mention the turnip cabbage, the winter cabbage, the summer cabbage, the crisped cabbage or savoy, and the cauliflower.

THE COMMON BEAN (*Phaseolus vulgaris*) is cultivated in many countries for the sake of its seed and husks. By cultivation many varieties have been produced, of which the following are the best known :—The golden climbing bean, the kidney bean, the French bean, and the scarlet-runner.

PEAS (*Pisum sativum*) and LENTILS (*Ervum Lens*) are also largely cultivated. Their seeds are very nutritious, but somewhat indigestible. Of the Asparagus only the young shoots are valued. The leaves of the Lettuce, of the Endive, and of the Garden and Water Cress are used for salads. Onions, Leeks, Porret, Celery, Parsley, Anise-seed, Dill, and Fennel are also favourite indigenous plants.

VI.—FIBRE PLANTS USED FOR SPINNING.

THE HEMP (*Cannabis sativa*) is cultivated in many countries. Its height is about three feet, and has finger-like leaves and diœcian blossoms ; the male blossoms grow in clusters ; the female blossoms are leafed and paniced. The fruit has the form of a little nut. The home of the hemp is the East Indies. The plants bearing male blossoms are pulled up immediately after the time of flowering, the others about four weeks later. The stalks are dried in the sun, then steeped in water or upon wet (moist) meadows, and again exposed to the sun, when the woody parts are stripped off. The remaining fibres are manufactured into cables, ropes, sail-cloth, linen, and

paper. Its seeds are medicinal, and are much used as food for caged birds ; they also yield oil.

The FLAX (*Linum usitatissimum*) has been cultivated for centuries. It is common in Ireland, Flanders, Livonia and Courland, Poland, Saxony, Silesia, Westphalia and

Wurtemberg. Along the upright stalk, of eighteen to twenty inches high, small narrow leaves grow ; the blossoms appear in July and August, and are light blue. The fruit is a multifid capsule.

In the flax, also, the fibres of the stalk and the seeds are most useful. The stalks are not allowed to die, but



Flax.

Hemp.

are left until they become yellow. The further treatment of the fibres of the stalks for the purpose of making thread and cloth is the same as that applied to the hemp. The fibres of the flax are finer, but weaker and not so durable as those of the hemp. The same holds good with regard to the spun yarn, and to the linen cloth. Its seeds supply the linseed oil which is used as medicine, and also in painting. That which remains after the oil has been pressed out, the so-called linseed cake, is much valued as food for cattle. From linen rags superior white paper is manufactured.

The COTTON PLANT (*Gossypium herbaceum*), Plate XIV., Fig. 7, is one of the most important cultivated shrubs.

The largest cotton plantations are in the southern states of the United States. Thousands of men are occupied in its cultivation and subsequent manufacture, and it furnishes the clothing of millions of people. In America the shrub-like species is chiefly cultivated, which is an annual plant. In the East Indies and China the tree-like species is grown, which yields yellow cotton.

The shrub species of the cotton is from eighteen inches to three feet high, and has upright branching stalks, with very long-stalked leaves. The pale-yellow blossoms, which are purple inside, develop into fruit capsules of the size of a walnut; the three cells of these capsules burst open when ripe, whereupon the snow-white wool of the seeds is seen, in which the black seed-grains of the size of a pea are arranged. The capsules are collected, and in the so-called cotton-house the wool is separated from its seeds by means of machines. Thereupon the cotton is packed up in bales, and despatched to all parts of the world.

VII.—PLANTS USED IN COMMERCE.

THE COMMON HOP (*Humulus lupulus*) grows wild in hedges and bushes, and is also frequently cultivated. Its stalk, which leans to the right, is eighteen to twenty-four feet high; its petiolate leaves are heart-shaped, with three to five lobes. The blossoms of its stamens form panicles; the female cones stand either singly in the axils of the leaves or in clusters. In these cones a yellow, bitter resin, the hop-powder or lupulin, is secreted, which yields the wort for beer, and is also used by the chemists. The young hop-shoots are

sometimes boiled and eaten. The leaves of this plant are also used as food for cattle.



The Hop Plant.

The SUGAR BEET is a variety of the MANGEL-WURZEL (*Beta vulgaris*). Its roots are knotty, have a solid (firm) sweetish flesh, and are used for the manufacture of sugar and as food for cattle. Every year about eleven million hundredweights of beet-root sugar are manufactured.

The TOBACCO PLANT (*Nicotiana tabacum*), Plate XIV., Fig. 8, is three to four feet in height; its leaves longish and lancet-shaped; its corolla pink; its fruit is a capsule, with many seeds.

The tobacco comes from America. Its leaves are either used for chewing, for smoking, or for snuff. It belongs to the poisonous plants, and contains no nutritious substance; its flavour and odour are disagreeable; nevertheless it furnishes much enjoyment to a large portion of mankind. Its cultivation gives occupation to thousands of men. The best qualities come from Havannah, Java, and Manilla. The tobacco leaves are medicinal.

The CHICORY PLANT (*Cichorium intybus*), Plate XIV., Fig. 9, grows everywhere along the country roads and waste ground, and can easily be recognised by its sky-blue blossoms. In some places it is also cultivated on a great scale, as its root is employed for forming an ingredient for the adulteration of coffee. Its young shoots are eaten as a salad, and the roots of the cultivated plants are used as vegetables.

The DRAPER'S TEASEL or FULLER'S THISTLE (*Dipsacus*

fullonum) has its home in the south of Europe. The lilac-coloured little blossoms stand in the shape of conical heads, which are enveloped by stiff bristles. Between the blossoms are small leaves, the thorny points of which are bent backwards. This plant is cultivated for the sake of its blossom heads, which are used for raising the nap of cloth. The price of a thousand blossom heads is from three to six shillings.

THE WILD FULLER'S THISTLE (*Dipsacus silvestris*), which grows frequently along ditches, is similar in appearance to the above.

THE GARDEN POPPY (*Papaver somniferum*). Its stalk is twenty to fifty inches high, its leaves greyish green, its blossoms large and white or pink, its capsulæ large and polyspermous. It is cultivated largely; its seeds yield a good sweet-oil, which is also used. The unripe poppy heads yield a milky juice, known, when dried, as opium.

THE COMMON RED POPPY (*P. rhoas*) is frequently found amongst the corn, and can be seen from a distance owing to its bright-red blossoms, which are used for medicinal purposes.

THE LIQUORICE PLANT (*Glycyrrhiza glabra*), Plate XIV., Fig. 10, comes from the south of Europe, and is cultivated in some districts for the sake of its root, which is of the thickness of a finger. The latter contains a sweet juice, from which liquorice is prepared.

THE BASTARD SAFFRON (*Carthamus tinctorius*), Plate XIV., Fig. 11, comes from Egypt, and is cultivated only in a few European districts. Its blossoms are used for dyeing in red and yellow, and are collected in August, when they begin to drop. Oil is expressed from the seeds.

VIII.—ORNAMENTAL PLANTS.

WE cultivate in our gardens plants of all kinds, which give us great pleasure on account of their lovely blossoms or their agreeable odours. Of these we will mention the following:—The snowdrop (*Galanthus nivalis*), and the similar-looking but little larger great spring snow-drop (*Leucojum vernal*); the hyacinth (*Hyacinthus orientalis*); the narcissus (*Narcissus poeticus* and *N. pseudo-narcissus*); the crocus (*Crocus vernus*), Plate XIV., Fig. 13. The tulip (*Tulipa Gessneriana*); and the imperial lily (*Fritillaria imperialis*), unfold their blossoms in the early spring. The primrose and auricula (*Primula veris* and *Pr. auricula*), the mignonette (*Reseda odorata*), the heart's-ease or pansy (*Viola tricolor*), belong also to the plants blooming in spring; the fuchsia, geranium, balsam, and the pinks bloom in summer; the astors and dahlias are true autumn flowers. In some gardens we find the passion-flower or virginian climber (*Passiflora cœrulea*), Plate XIV., Fig. 12. Its blossoms are white with a sky-blue tinge at the top. Its fruit is eaten in Mexico and Brazil.

IX.—FODDER PLANTS.

BESIDES the grass of the meadows, which both in a fresh and dried state as hay serve as food for the cattle, a great number of other herbs are cultivated for fodder. Most of them have peculiarly shaped blossoms, so called butterfly blossoms, which enclose the seed-bud (ovary), ten stamens, and one pistil. To these belong the meadow clover (*Trifolium pratensis*), the white clover

(*Tr. repens*), the flesh-coloured clover (*Tr. incarnatum*), the common sainfoin (*Onobrychis sativa*), the snail clover (*Medicago lupulina*), the lucerne (*Medicago sativa*), and the common vetch (*Vicia sativa*). A much-valued fodder is the bird's-foot trefoil (*Lotus corniculatus*), Plate XIV., Fig. 14, which is frequently found growing in meadows.

The COMMON BUCKWHEAT (*Fagopyrum esculentum*), Plate XIV., Fig. 15, is chiefly cultivated in sandy districts in which corn will not thrive. From its grains the buckwheat grits are prepared. Bread is made from a mixture of buckwheat and cornflour. The grains also yield beer and brandy. This plant is a good and nutritious fodder for cattle, and its blossoms are favourites of the bees, as they yield a rich honey.

X.—POISONOUS PLANTS.

A NUMBER of our indigenous plants contain so powerful a poison that we must all take care to avoid them. And as the danger may be better avoided by a general knowledge of the poisonous plants, we shall give a more detailed description of the latter, and will remark in the first place that many of them are also important medicinal plants. We should therefore by no means regret the existence of these poisonous growths; for, if we apply them to their proper uses, they serve to furnish us with renewed energy in our times of ill-health.

The MARSH CROW'S-FOOT (*Ranunculus sceleratus*), Plate XIV., Fig. 16, grows in ditches and marshes. The upright branching stem is from twelve to eighteen inches high; the leaves are divided in the shape of a hand, and the blossoms are small and yellow. The marsh crow's-

foot contains very poisonous juices, which cause blisters and ulcers to rise on the skin, and when taken inwardly nearly always cause death. The other species of crow's-foot found in meadows, fields, woods, etc., are also more or less poisonous.

The BLACK HELLEBORE (*Helleborus niger*), Plate XIV., Fig. 17, blooms in December, January, and February, and is a native of the mountainous woods of South Germany and Austria. The black root, which is white inside, is poisonous.

The GREEN and STINKING HELLEBORE (*H. viridis* and *H. foetidus*) are also rightly described as poisonous plants. The latter is also used for killing lice and vermin on cattle, horses, etc.

The WATER HEMLOCK (*Cicuta virosa*), Plate XIV., Fig. 18, is very common in many districts on the banks of streams, ditches, and in flooded fields; in other localities it is rare. The thick fleshy root is hollow, and divided in the interior into sections; the upright stem is hollow and smooth; the leaves are tripennate; the small white blossoms are arranged in umbels of ten or more rays. The poison is chiefly contained in the red root, which, when eaten by children, who mistake it for an edible root, nearly always causes death, unless medical aid is immediately at hand. The other parts of the plant also contain a poison, which is so strong that its odour alone will bring on headache and giddiness.

The SPOTTED HEMLOCK (*Conium maculatum*), Plate XIV., Fig. 19, grows upon rubbish, hedges, fences, and highways. The stem is three to six feet high, marked with blue and bluish-red spots; the leaves are tripennate; the white blossoms also stand in flat umbels. The leaves when bruised emit a very peculiar mouse-like odour,

which is especially noticeable on hot summer days. The root, especially, is poisonous, and when eaten causes the most fatal consequences. Hemlock is a powerful sedative, and is used medicinally.

The FOOL'S PARSLEY or DOG'S PARSLEY (*Æthusa Cynapium*) is a common weed, growing in gardens, fields, and also on rubbish. It is easily mistaken for parsley. As it is very poisonous, it is well to remember that it can be easily recognised by three long pendent floral leaves on solitary umbels; the leaves are odourless, and only when crushed emit a faint garlic-like scent.

WOLF'S-BANE or MONK'S-HOOD (*Aconitum Lycotonum*), Plate XV., Fig. 1, is a rare plant from eighteen inches to three feet high; the leaves are shaped like a hand, with three, five, or seven lobes. The blossom is yellow. The wolf's-bane contains a virulent poison, especially in the root and in the seeds. This description also applies to the *Aconitum Napellus*, which is grown as an ornamental plant in gardens; its tubers are used medicinally.

The DEADLY NIGHTSHADE (*Atropa Belladonna*), Plate XV., Fig. 2, is common in the woods. The sappy stem is from three to six feet high; the egg-shaped leaves are covered with down; the brownish-red blossoms are arranged solitary in the axils of the leaves. The bright black berry is as large as a cherry. The nightshade is our most dangerous poisonous plant, and there is little hope for children who have eaten of its berries. From the fresh leaves atropine is prepared, which is a very powerful remedy in certain diseases of the eye.

The HENBANE (*Hyoscyamus niger*), Plate XV., Fig. 3, grows on rubbish and waste ground. The entire plant is covered with sticky hairs, and has a repulsive odour.

The stem is about thirteen inches high ; the longish leaves are widely serrated ; the blooms are pale yellow, streaked with dark-violet veins ; the fruit is a capsule, which opens with a spring lid. The henbane is also a dangerous poisonous plant, but its leaves and seeds furnish an important medicine.

The THORN APPLE (*Datura Stamonium*), Plate XV., Fig. 4, originally came from the East Indies, but is now widely spread, growing on rubbish and in gardens. Never more than a few plants are found. Its forked stem is from eighteen inches to three feet high ; the petiolate leaves are widely serrated ; the large blossoms are a pure white ; the fruit resembles the horse chestnut, and contains numerous black seeds. The thorn apple has a very repulsive odour, a disagreeable flavour, and is poisonous in all parts. The leaves and seeds are used in medicines.

We may also mention here the CLIMBING and the BLACK NIGHTSHADE (*S. Dulcamara* and *S. nigrum*), the blossoms of which closely resemble those of the potato. The black and red berries of these plants must be avoided.

The MEZEREON (*Daphne Mezereum*), Plate XV., Fig. 5, grows solitary in the woods. It is a tough plant, from one to three feet high ; the lanceolate leaves are arranged in tufts at the end of the shoots ; the rose-coloured blossoms appear before the leaves, and are generally situated in clusters of three on the branches ; the fruit is a red stone-fruit. The whole plant is poisonous ; a medicine is prepared from the bark.

The PURPLE FOXGLOVE (*Digitalis purpurea*), Plate XV., Fig. 6, is a common wild flower in Britain, and grows to a height of fifty-four inches. The longish leaves



are felt-like, and the large purple blooms stand in a unilateral cluster; the fruit is a capsule. The purple fox-glove is poisonous, and its leaves are used in medicine.

The HERB-PARIS (*Paris quadrifolia*), Plate XV., Fig. 7, grows in hedges and shady woods. On its upright stem there are four oval leaves. It has never more than one bloom, consisting of greenish-yellow petals, eight stamens, and one pistil. Its fruit is a dark-blue, round berry, which ripens in July and August. The latter when eaten causes diarrhœa, convulsions, and other disturbances.

The MEADOW SAFFRON (*Colchicum autumnale*), Plate XV., Fig. 8, is a bulbous plant, which blooms in dry meadows in September and October. The flesh-coloured blooms appear in the autumn, and leaves are thrown up in the following spring; between the leaves are large capsules, each containing numerous seeds. The seeds and the bulbous root contain poison, and the former are used in medicine.

The DARNEL (*Lolium temulentum*), Plate XV., Fig. 9, is from eighteen to thirty-six inches high, and often found in corn-fields. Its seeds contain a poison, which is said to be narcotic and stupefying.

XI.—WILD-GROWING PLANTS AND WEEDS.

THE wild-growing plants, partly known as weeds, are gradually disappearing before the advance of cultivation. They are still, however, to be found under the shade of trees, in bushes and hedges, amidst grasses on meadows, on highways and declivities, and on rubbish heaps and in water; they crowd together, as though unwilling to be

seen amidst the corn and vegetables growing in the fields, but some add to the beauty of the latter by their pretty blossoms.

Following out the aim of this work, we will now describe the leading representatives of these plants, grouping them according to the localities in which they are found.

1. In the Woods we find wild plants partly under the shade of trees, partly growing in clearings. In the early spring the lungwort (*Pulmonaria officinalis*) delights us with its violet and blue flowers ; as does also the liverwort (*Hepatica triloba*), the three-lobed leaves of which live through the winter. That familiar little favourite, the sweet-scented lily of the valley (*Convallaria majalis*), raises its tender string of blooms surrounded by two large leaves in May. This is followed by the sweet-scented woodruff (*Asperula odorata*) (see cut). In some districts the fresh leaves of the woodruff are used for making May wine ; when dried they emit an agreeable scent, and are therefore frequently laid in wardrobes. Its



Woodruff.

leaves are stellate, and its small blossoms are arranged in umbels. It grows from nine to twelve inches high. Other plants found in the woods are the *Galicumsilvaticum* and the forget-me-not (*Myosotis silvatica*). About the month of May the milkwort (*Gnaphalium dioicum*) blooms, which in some parts of Europe is twisted into wreaths and hung up in cow-stalls, as a charm to preserve the cattle from diseases and other evils. A familiar plant in clearings and pastures is the *Potentilla Tormentilla*, also called tormentil. It has a horizontal or upright stem, with rather small yellow blossoms. The

large brown root, which is red inside, is used in medicine. Another familiar plant is the centaury (*Erythraea Centaurium*), Plate XV., Fig. 10. Its rose-red blossoms are arranged in clusters, and its leaves have medicinal properties. Late in the year towards autumn the common ling or heather (*Calluna vulgaris*) (see cut) opens its red blooms. The leaves are small, and arranged in four rows along the stem. The young heather contains a rich honey, and is consequently much sought after by all kinds of insects.



2. In the HEDGES and BUSHES we find the first Ling. harbingers of spring early in March and April. In concealed spots the sweet-scented violet blows (*Viola odorata*), which fills the air with its sweet fragrance every morning. The anemone (*Anemone nemerosa*) raises its white flower, tinged with red, from the midst of three large green leaves. The wood-sorrel (*Oxalis acetosella*), Plate XV., Fig. 15, sends out from its root graceful trifoliate leaves and white blooms traversed by violet veins. This plant was formerly used for the manufacture of salts of sorrel. In the hedges and bushes we meet with the arum (*Arum maculatum*), Plate XV., Fig. 12 (the common wake-robin or lords and ladies). On closely observing this plant, we shall find rather deep in the earth a tuberous root as large as a walnut, from which spring three or four long-stalked bright leaves. Between the leaves a smooth stem arises six to nine inches high, which bears at its upper end the blossoms, surrounded by a greenish sheath. The stamens and pistils are arranged separately round the lower part of the brownish-red thalamus. As the stamens do not release the pollen until the stigmas of the pistils near them are faded, no fructification can take place without some

external aid. This aid is furnished by small gnats, which are attracted to the plant by the peculiar scent of the blossoms, and also by the warmth prevailing in the interior of the bloom. As soon, however, as the gnats enter the flowers, their egress is blocked by small filaments which line the interior of the sheath. Here the insects must remain for a considerable time until the pistils open, when they fructify the latter by means of the pollen which they have brought on the fine hairs covering their bodies from another arum flower, receiving as a reward for their services a little drop of honey. But they must remain yet longer until the stamens open and discharge their pollen over the insects, completely powdering them. The bars of the prison now wither, and the gnats are then free to escape and visit another arum. The arum has acrid properties, but its corm yields Portland sago or arrowroot. In the vicinity of this plant we also find the valerian (*Valeriana officinalis*), the root of which possesses healing properties. It contains an oil, which is used as a remedy for cramp.

3. The uniform green which covers the MEADOWS all the year round is agreeably relieved by a large number of plants with coloured blooms. Here blooms the sky-blue gentian (*Gentiana verna*) (see cut), which delights both the eye and the heart. There the beautiful blue bells of the campanula (*Campanula Rapunculus*) raise their heads, together with the violet flowers of the scabious (*Scabiosa pratensis*), and the numerous bloom-



Gentian. whorls of the meadow sage (*Salvia pratensis*). Between these can be seen the red and white heads of the meadow and white clover (*Trifolia pratensis* and *T. repens*); and from a distance we can recognise the

small daisy (*Bellis perennis*), the similar but larger dog daisy (*Chrysanthemum leucanthemum*), the yellow meadow sweet (*Tragopogon pratensis*), and the dandelion (*Taraxacum officinale*). In these, also, the fructification is carried out by insects ; but, as the single blooms are so small that they would be overlooked by the insects, the Creator has arranged many of them in the form of a small chalice or cup, which can be seen from afar, especially in those cases where the radiating petals are different in colour from the sepals, like in the dog daisies. Many meadow plants grow with their stalks and blooms high over their neighbours, as though they were the lords of the meadows. This is the case with the umbellate flowers: the cumin (*Carum Carvi*), the wild anthriscus (*Anthriscus silvestris*), the goat's-foot (*Ægopodium Podagraria*), and the hog-weed (*Heracleum Sphondylium*). In these the blooms are very small ; but as they are united in large numbers in flat umbels, they show up well. The bitter crow's-foot (*Ranunculus acris*) and the butter flowers (*Caltha palustris*), blooming along the ditches, strive to attract our attention with their bright yellow blossoms, but they are not to be trusted, since both belong to the poisonous group of Ranunculi. On the dry ridges blooms the plantain (*Plantago*), which has good healing properties ; and the wild thyme (*Thymus Serpyllum*), Fig. 1, a graceful plant, which is sometimes made into tea, and is frequently placed in children's baths. The shape of its blooms shows it to be a member of the family of the labiate flowers, to which belongs also the meadow sage.

Another large natural family of plants, the milkworts, have a pretty representative in the meadows in the cuckoo flower (*Cardamine pratensis*), Fig. 2. Its leaves are pennate,

and the lilac-coloured blooms contain four large and two short stamens ; the fruit is a pod. Upon woody meadows



Fig. 1. Wild Thyme.



Fig. 2. Cuckoo Flower.

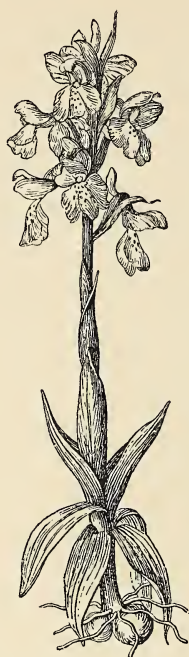


Fig. 3. Orchis.

we also often find the orchis (*Orchis Morio*), Fig. 3. From the two oval tubers a stem arises enclosed in sheath-like leaves. At the top of the stem are the curiously formed flowers, which are fructified by insects in a very peculiar and striking manner. The somewhat unattractive sour sorrel (*Rumex Acetosa*), Plate XV., Fig. 13, is well known, and its soft stem and juicy leaves are sometimes eaten by children. The leaves are arrow-shaped ; the small flowers are reddish in colour.

4. On HIGHWAYS, WASTE STRIPS OF LAND, and RUBBISH HEAPS we meet, besides old acquaintances from the meadows, the groundsel (*Senecio vulgaris*) and the chickweed (*Stellaria media*), both valued as birds' food, and common everywhere ; the shepherd's pouch (*Capsella Bursa pastoris*), easily recognised by its almost three-cornered little pods, and blooming, like the groundsel, nearly all the year round ; the white, spotted, and purple blind-nettles (*Lamium album*, *L. maculatum*, and *L. purpureum*), and the origanum (*Origanum vulgare*), are labiate flowers, which are diligently visited

by insects for their honey; the celandine (*Chelidonium majus*) yields a yellow milky sap, which is used as a remedy for warts; the verbascum (*Verbascum*), with partly white, partly yellow flowers, which are medicinal; the *Ononis spinosa*, a papinaceous flower with sharp thorns; the bristly, blue-flowered adder-wort (*Echium vulgare*); the round-leaved mallow (*Malva rotundifolia*); the burdock (*Lappa major*), the blossoms of which cling to the clothes so readily; the common nettles (*Urtica*); and the tansy (*Tanacetum vulgare*), Plate XV., Fig. 11.



Fig. 4. Larkspur.

5. Several plants grow amid the corn which are really ornamental with their bright flowers. A very pretty example is the larkspur (*Delphinium Consolida*), Fig. 4, a small graceful little plant, with numerous blue spur-like flowers. Near the latter we also find the favourite flower of the late Emperor William of Germany; viz., the blue cornflower (*Centaurea Cyanus*), which is so frequently plucked by children and woven into wreaths.

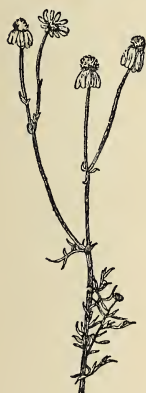


Fig. 5. Camomile.

The camomile (*Matricaria Chamomilla*), Fig. 5, is recognised by its strong odour. It has a small chalice with white petals, and is an important medicinal plant. The corn-

cockle (*Agrostemma Githago*) and the red poppy (*Papaver Rhæas*) are also seen; and at the time when the wind sweeps over the field of stubble the latter is adorned with the wild pansy (*Viola tricolor*), the leaves and flowers of which have healing properties, and are collected for medicinal uses.

6. On the banks of streams and in water we find, besides those plants suitable for an aquarium already mentioned on page 132, the shave-grass (*Hippuris vulgaris*), Plate XV., Fig. 14.

XII.—THE GRAMINACEÆ, OR GRASSES.

THE roots of most kinds of grasses are persistent ; the stems are hollow and knotty, and the leaves consist of sheaths and discs. Their flowers are arranged either in spikes or panicles, and are essentially the same in form as those of the herbs. In the interior there is an ovary, from which project two pistils with feathery styles. Close to the ovary are three stamens, with very long filaments and large anthers. These internal organs are generally surrounded by two tender bracts called the *paleæ*, and two harder outer bracts forming the *glumes*. In the grasses also self-fertilisation does not take place, the wind here taking the place of the insects. Consequently the anthers are suspended from long filaments, and contain a quantity of pollen. As the grasses do not need to attract insects, their flowers are small with little colour, and have no scent ; nor do they secrete honey. The fruit is enclosed in a husk.

I.—THE CEREALS.

These contain seeds rich in meal, which are used as food. They are the most important produce of the earth, and were apparently brought to Europe from Asia.

The RYE (*Secale cereale*), Fig. 6, *d*, is cultivated in all northern countries. The stalk grows up to six feet, and the ears are double-rowed. One of the two long *paleæ* has a long beard. The grain is dark green and

very mealy, and furnishes a good bread. From the grain a kind of brandy is manufactured, as well as rye coffee. There is summer rye, winter rye, etc.

The COMMON WHEAT (*Triticum vulgare*), Fig. 6, *b*, does not grow so high as the rye, but has a thicker stalk



Fig. 6.

and thicker ears, which are composed of several small ears. In each little ear there are generally four seeds. There are, as a rule, no beards; but, on the other hand, there is often a short spur at the top of the ears. A white bread is manufactured from the grain, and the latter also furnishes a kind of brandy. The unripe grains, when

dried, can be made into good soup. Straw hats are woven out of the stalks. The following are the various species of wheat : spiked wheat, bearded wheat, bur wheat, and summer wheat. The English wheat (*Tr. turgidum*) is bearded.

The SPELT (*Triticum Spelta*), Fig. 6, *e*, is chiefly cultivated in South Germany. The small ears are arranged on a brittle stalk, and consist of three or four blooms, of which, as a rule, only two are fruitful. Spelt is, generally, not bearded. The corn furnishes a white bread. When unripe, it is manufactured into a soup, which is highly esteemed. Rarer species are *Tr. dicoccum* and *Tr. monococcum*.

The DISTICHOUS BARLEY (*Hordeum distichon*), Fig. 6, *a*, also called summer barley, has only two rows of corns in the ear ; the remaining blossoms contain only stamens, and are therefore unfruitful. The exterior husk of the fruitful blooms has a very long beard. From barley are manufactured meal, grits, malt, and pearl barley. Barley bread soon becomes dry and hard, and is therefore not liked. But barley is much used as malt in breweries and for the manufacture of brandy ; it is also used as poultry food. Other varieties are the common barley (*H. vulgare*), *H. cœleste*, *H. hexastichon*, etc.

OATS (*Avena sativa*), Fig. 6, *c*, have a broad panicle ; the individual ears are two-rowed, with and without beards. The grain is made into bread, used in various forms of porridge, and also as food for horses. Another much-cultivated species are the bearded oats (*A. orientalis*).

The COMMON RICE (*Oryza sativa*), Plate XV., Fig. 17, belongs to the most important of the Graminaceæ. It is grown in nearly all the warmer countries of the earth, and forms the daily food of many millions of people.

There are two varieties—the mountain rice and the marsh rice, the latter being the most cultivated.

The COMMON MILLET (*Panicum miliaceum*), Plate XV., Fig. 18, is a native of the East Indies, and is widely grown in North Italy. It is about three feet high; each panicle contains five to six hundred grains, which furnish a good meal.

To the Graminaceæ belongs also the maize (*Zea Mays*), which is a native of Central America. The variously coloured grains serve as a food for men and animals.

II.—THE GRASSES PROPER

grow upon our meadows, pastures, fields, and in the woods, and are only used as food for cattle. The most familiar kinds are the graceful quaking grass (*Briza media*), Plate XV., Fig. 19; the fox-tail grass (*Alopecurus pratensis*), Timothy grass (*Phleum pratense*), *Poa pratensis*, *Dactylis glomerata*, and the English ray grass (*Lolium perenne*.)

Among the false grasses are the rushes (*Scirpus*) and the wool grass (*Eriophorum*), etc.

A tree-like grass is the SUGAR-CANE (*Saccharum officinarum*), Plate XV., Fig. 16. It grows nine to fifteen feet high, and contains in its pith a sweet sap, from which our raw sugar is obtained. The sugar-cane is a native of the East Indies, but it is now grown in many countries of the Torrid Zone. The exports of sugar annually from these countries amount to about three hundred thousand tons.

XIII.—THE CRYPTOGRAMS.

THE Cryptogams are plants without true, or without

visible, blooms ; to these belong the shave grasses, the ferns, the mosses, the algæ, the lichens, and the fungi.

The HORSE-TAIL (*Equisetum arvense*), Plate XVI., Fig. 1, frequently grows in damp sandy fields. The spring stem (1 *a*) of the plant is simple and reddish in colour, and bears fruit called spores in an upright ear. Fig. 1 *b* is a horizontal section of the stem. The green branching and unfruitful summer stem contains siliceous matter, and is used for cleaning tin-ware, and also for polishing purposes.

The WALL RUE (*Asplenium Ruta muraria*), Plate XVI., Fig 2, belongs to the family of ferns. It grows everywhere on walls, and has a short root, three-cornered leaves, and along both sides of the middle ribs of the leaves the fruit lies in rows.

The COMMON FERN or POLYPODIUM (*Polypodium vulgare*), Plate XVI., Fig 3, grows on walls and rocks. It has a creeping stem, and beautiful serrated leaves; bearing on their underside the somewhat large fruit glands which contain the spores. Other familiar ferns are the worm fern (*Aspidium Filix mas*), and the eagle fern (*Pteris Aquilina*), which grows from three to five feet high.

The COMMON HAIR MOSS (*Polytrichum commune*), Plate XVI., Fig. 4, grows in all the woods, and in peat fields. The stem is upright ; the small leaves are pointed and serrated at their edges. The spores develop in a quadrangular sheath, which is surrounded by a cell. The mosses play an important part in the economy of Nature ; they retain in the woods a quantity of the water which falls as rain, and thus preserve the lands from being flooded, store up moisture for the plants, and also influence the climatic conditions of a country. The



so-called peat moss (*Sphagnum*) enters largely into the composition of peat.

The REINDEER MOSS (*Cladonia rangiferia*), Plate XVI., Fig. 5, is a much-branched little plant of a greyish colour. The small fruit corpuscles are at the ends of the branches. The reindeer moss is common in the pine woods of Northern Europe.

The TOAD'S-STOOL (*Agricus muscarius*), Plate XVI., Fig. 6, grows in the woods in autumn. The blood-red cap has numerous white excrescences on its surface. It is very poisonous and stinking, and has a bitter taste. It is often used as a poison for flies, but is also dangerous to men and animals.

The MUSHROOM (*Agricus campestris*), Plate XVI., Fig. 7, is common from May to October in fields, gardens, and meadows which have been manured with dung. It has lately also been cultivated in cellars and greenhouses. It is a favourite article of food, and one of the most useful of the edible fungi.

The BOVISTA NIGRESCENS, Plate XVI., Fig. 8, is bulb-like and stalkless, and is as big as a walnut. It is found in summer and autumn in meadows and pastures. It is not poisonous, but it has an unpleasant flavour.

The EDIBLE MORIL (*Morchella esculenta*), Plate XVI., Fig. 9, grows in mountainous woods in the early spring. On the Continent it is collected and sent, fresh and dried, to market. It is chiefly used as a herb for soups.

The POISONOUS MORIL (*Phallus impudicus*), Plate XVI., Fig. 10, can easily be mistaken for the edible moril. When it first appears above the earth it resembles a hen's egg; then the skin breaks, and the stem rises with its cap. The latter is at first covered with an odorous slime, but as soon as this has dried an

opening is seen at the top of the cap—this forms the chief distinguishing feature. The poisonous moril has a disagreeable appearance, and is generally infested with insects; nobody is, therefore, likely to be tempted to eat this poisonous fungus.

The *CANTHARELLUS CIBARIUS*, Plate XVI., Fig. 11, is common in pine woods in summer and autumn.

To the fungi also belong other very small forms, commonly known as MOULDS, such as the *Mucor Mucedo* and smut (*Ustilago segetum*); the former often found on bread and fruit, the latter on corn.

Arrangement of a Herbarium.

The botanist will require the following appliances:—A japanned tin box, a gardening trowel for digging up the plants, a good pocket-knife, tweezers, a microscope, and a fine lance fitted in a wooden handle; also a press, which in its simplest form consists of two smoothly planed little boards, which are loaded with stones; and some white blotting-paper and newspaper.

The plants collected, if they are not too large, are so placed in the tin box that their roots all lie in one direction. Smaller specimens should be wrapped in bibulous paper; a suitable branch with leaves and blossoms should be cut from trees, bushes, and larger plants.

The following rules should be observed in arranging and pressing the plants:—Thick roots, bulbs, tubers, and thick heads of flowers should be cut in half, and only one half dried. Rich clusters of blossoms should be so cut away that in pressing no two blooms shall lie together. The plants should be placed either between one folded sheet of blotting-paper or between two sheets. Plants of

the same thickness can be pressed in the same layer. If it should happen that leaves are lying upon or underneath a stalk, they should be separated from the latter by small pieces of blotting-paper. In larger flowers the stamens and pistils should be enveloped in blotting-paper, to prevent the corolla from being stained. The flowers should be arranged in three ways, so that the calyx and corolla may be seen from the top, side, and base.

Fifteen to twenty plants should be pressed at once, separated from each other by four to six sheets of newspaper or by the lid of a cardboard box. The press should be kept in a dry place, and the plants should be frequently moved, and fresh blotting-paper put in. As the plants dry the pressure should be increased.

When the plants are dry (eight to ten days), they should be separately fastened on to the third page of a sheet of white note-paper. On the first page the name order, etc., of the plant should be written. Plants belonging to the same species should be kept together. Each case should contain a family, if the herbarium is arranged according to the natural system.

Many collectors have special collections for leaves, blooms, fruits, and seeds; and also a bud collection, formed, in winter, of twigs of trees and plants. There may also be a collection of woods (Fig. 7), of the various trees and plants. These specimens show the bark, grain, pith, etc.; and we may here compare the various woods according to their hardness, weight, fissile properties, etc.

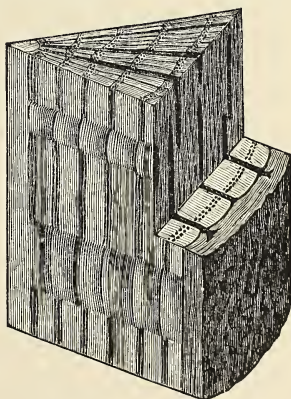


Fig. 7. Piece of Oak.

THE MINERAL KINGDOM.

THE minerals now found upon this earth were originally not in existence. They have been formed and developed in the course of thousands of years from gaseous vapours and water, undergoing numerous changes by heat and refrigeration, by melting and cooling, elevation and sinking, contortion and dislocation, and various other disturbances more or less violent. And their original conformation and constitution have especially been modified by the influences above mentioned.

In regard to their arrangement in strata, and their consolidation and composition, the minerals may be divided into classes according to their occurrence and to their origin. In the former arrangement we have first such minerals as are spread over a large area and form the chief component parts of the earth's crust, thus entering largely into the formation of mountain chains. These are called rocks. The other species are much less widely spread, and appear more in disconnected layers of peculiar forms, generally enclosed by the mountain rocks, and filling up the intermediate spaces to a greater or lesser extent. These layers are designated by different terms, such as galleries, strata, beds, etc. Rocks which originated in a melted state are called igneous rocks, while the other kinds of rocks are known as sediment

rocks. The latter have been formed by aqueous deposits, and have therefore settled in regular layers one above the other. These are also called stratified rocks, whilst igneous rocks are termed primitive rocks.

Rocks are divided according to their ages into five life periods. To the Archæan period belong the fundamental gneiss; the second period is the Primary period, and includes the silurian rocks and carboniferous rocks, etc.; the Secondary period includes the jurassic rocks, etc.; the Tertiary period the eocene and miocene rocks; and the Post-tertiary includes the recent rock formations. Nearly all the members of the above-named formations are of great importance, and play a more or less prominent part in human economy, as is evident by considering the various uses of coal, chalk, sandstone, and other minerals.

The sedimentary or aqueous rocks include the petrified remains of plants (Fig. 8) and of animals, and thereby furnish evidence of the extinct forms of animals of the ancient world, and also of the great age of the earth prior to our historic era. The igneous rocks do not contain animal or vegetable remains.

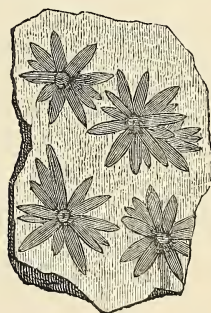


Fig. 8.

Minerals properly so-called in distinction to plants and animals are such natural objects as do not possess any organisations; that is, no organic system by which they are enabled to absorb nutritious matter, or to digest it and employ it for increasing their growth. They do not propagate; neither do they possess motion. It is, however, a mistake to assert that minerals are entirely without any organisation; for although they have

no such system as that possessed by the other forms occurring in natural history, yet they have a certain organisation, as is proved by the differences in their chemical composition, in the manner in which their component parts are combined, and also by the differences in their hardness, weight, fusibility, texture, and other points, and further in their exterior formation.

With regard to the last point, minerals are distinguished into those which are amorphous and those which form crystals. The latter include such as present definite conformations of their surfaces, edges, and angles. But even among those minerals which do not form crystals there are some in which the formation gravitates towards a certain shape.

In the interior of the earth there are hidden peculiar forms of minerals, which the industry of man now brings to the surface. By this industry mines have been sunk in which thousands of labourers are continually engaged in digging out and bringing to the surface that which is in the underground storehouse of this planet. We cannot over-estimate the importance and value of the stones obtained from quarries for use in building, and of the metals, coals, and salts which are worked in pits and mines, and are so indispensable, in their various ways, to every-day life. The minerals are divided into metals proper, and into non-metals or metalloids. Among the non-metals we may mention sulphur, an inflammable mineral found in lime, gypsum, and marl, also in volcanoes, and, again, forming a constituent part of spring water. SULPHUR is an important article of commerce, and is used for bleaching, medicinal purposes, etc.

In the carbonaceous group the DIAMOND has the

first place as a precious stone. It is found in Brazil, the East Indies, South Africa, Borneo, and Sumatra, having numerous variations in colour and lustre. Owing to its hardness, it is used by glaziers for cutting glass.

GRAPHITE is the mineral from which the lead for our pencils is manufactured. It is found in several parts of Europe and Asia.

One of the most important minerals is PIT COAL. This is not only used as an ordinary fuel, but it is an indispensable mineral for railways, steam navigation, and factories. Coal-tar, which is obtained from coal, is now employed for the preparation of the much-valued aniline dyes. If we compare the large yearly consumption of coal with the quantity of coal produced from the pits, we can easily imagine that the supply must be exhausted after a certain number of years. And an assumption of this kind is, indeed, justified, because the continual increase in consumption must finally exhaust the mines; but the time when this exhaustion will take place is still very far distant, and the supply in the pits which are now worked, to say nothing of those which may yet be discovered, will suffice to satisfy the demand for an incalculable period. But even if such a period of exhaustion should arrive, human inventive genius would no doubt speedily find another fuel to replace coal.

The richest coal-mines are situated in England, Belgium, America, and the western provinces of Germany. Ordinary pit coal is also called black coal, to distinguish it from anthracite and brown coal, or lignite. The latter is found largely in several districts of Germany and Saxony. Coal is formed from vast

masses of vegetable matter deposited through the luxuriant growth of plants in former epochs of the earth's history.

In connection with coal we may mention rock oil or petroleum, which is obtained in large quantities from Southern Russia and North America, and gushes out of the ground in a liquid state. The yearly consumption of petroleum amounts to over twelve million hundred-weights. Asphalt or bitumen has recently been largely employed in road-making, and in the construction of buildings.

AMBER is a fossil resin, the produce of extinct trees. It is found in the sea and along the shores of the Baltic. It has a yellow colour, and from the earliest times has been used for the manufacture of ornaments; it is now largely employed for the mouthpieces of cigar tubes, and also in the preparation of varnishes.

QUARTZ is a common mineral, forming not only the chief ingredient in sandstone, but also entering into many varieties of precious stones. Among the latter we may mention the rock crystal (Fig. 9); the violet amethyst; the brown topaz; the chalcedony, with peculiar white lustre; the agate, of various colours; and the various kinds of opals, of which

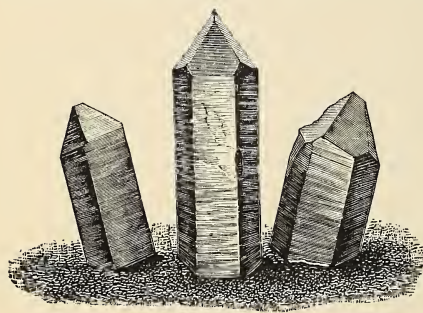


Fig. 9.—Rock Crystals.

Pliny said, "In the opals there lies the fire of the carbuncle with the sea-green of the emerald, combined in one lambent flame."

In another group we may mention the corundum, the

emery, the spinel, and the salts, and of the latter above all the rock salt.

COMMON SALT is obtained from various sources, and appears in various forms. As rock salt it is broken up, and can be often used at once in its natural state. The purer this salt is, the whiter and more transparent it appears; when it exhibits a grey colour other substances are mixed with it, from which it must be freed. The biggest salt-mine in the world is situated at Wieliczka in Galicia, which furnishes above one million hundred-weights of salt a year, and employs more than twelve thousand men. It is eleven hundred feet deep, and contains four galleries, in which there is a chapel and a dancing-saloon, so some idea may be obtained of the vast extent of this wonderful subterranean structure.

Other sources of kitchen salt are the salt springs. In these the briny water is sometimes pumped up by machinery, and poured over piles of brushwood. By this method the water rapidly evaporates, so that only the salt remains. It is afterwards dried in pans. Sometimes the water is at once poured into large flat pans, where it evaporates, leaving the dry salt behind.

Other salts, which are of importance for manufacture, or medicinal purposes, are alum, sal-ammoniac, saltpetre, borax, glauber salts, and many others. In this class we may also mention the fluor-spar, the ponderous spar, Epsom salts, soda, lime, magnesium, limestone, talc, meerschaum, serpentine, mica, hornblende, feldspar, porcelain, and argillaceous clay. The limestone, marble, and gypsum are largely employed in the building trade, and the two latter are also used by sculptors. White marble which is obtained from Carrara in Italy is very celebrated.

Another important mineral is the ARGIL CLAY, from which vessels of all kinds are made, varying in quality, fineness, and colouring. The common potter's clay is more or less brown in colour, and is made up into earthenware vessels. Porcelain clay remains white and half transparent after having been in the fire. It is found in granite and porphyry in the form of layers and beds, chiefly in China, and in some districts of Germany, England, and France. From this clay white china wares, vases, etc., are manufactured. From ordinary clay are obtained bricks and tiles.

The argillaceous earths form more or less extensive strata in the recent rock formations. Talc is the constituent part of whole chains of mountains. Serpentine is used for making braying dishes, mill runners, colour trays, and objects of art. From meerschaum pipe bowls are made, the manufacture of which formerly formed an important branch of commerce. Some kinds of earth also yield pigments like ochre, umber, bole, green earth, yellow earth, etc.

The second division is formed of the heavy ores. To get at these ores or metals pits and mines have been sunk similar to the coal-mines. Metals are not only used for the manufacture of machines, arms, tools, and implements of all kinds, but are also used for medicinal purposes and for the preparation of colours; some of them are of a very poisonous nature.

PLATINUM is of a greyish colour, ductile, but very difficult to melt, and can only be decomposed by aqua regia. These qualities render it very suitable for crucibles and vessels in chemical experiments. It is generally found in small pieces, rarely in lumps, and chiefly in the Ural Mountains, and in some districts of North and South

America, also in the East and West Indies, and in small quantities in the Rhine.

GOLD is one of the best known and most precious of metals, and is used not only by civilised nations, but also by the savage inhabitants of the earth. In the earliest historical periods it was manufactured into different ornaments, and a great but imaginary value has always been attached to it. This has no doubt been caused by its beautiful colour and brightness, and by the readiness with which it can be worked. Gold is soluble in aqua regia, and can easily be melted; and so great is its ductility that it can be beaten into leaves of the most extreme thinness, which are used, under the name of gold-leaf, by gilders, and for the ornamentation of different objects, and largely in book-binding. Gold is also, as is well known, used for all kinds of fancy and ornamental articles, for coins, and the manufacture of medals. A valuable colour is also obtained from gold. The richest gold-mines are now in California, Australia, and South Africa. This precious ore is rarely found in a pure state. It sometimes occurs in the form of cubes, but more frequently in veins of various formations, mixed with other metals.

This is also the case with SILVER, which contains mixtures of copper, antimony, and sometimes even minute particles of gold. Silver has been found pure in the form of a crystal, but it usually occurs mixed with other mineral substances. This also is very ductile and easily melted. It is made up into different articles and ornaments, and also into household implements, such as candlesticks, cases for instruments, snuff-boxes, etc. Its chief use is in the form of currency. It is then mixed with copper, as is also the case when it is worked up into

other articles. Silver is also used for medicinal purposes. It is found in America, especially in Mexico, and in various parts of Europe.

QUICKSILVER or MERCURY is a powerful poison, and is used in medicine and for the preparation of various colours. It is generally found in the same localities as silver. A remarkable feature of this metal is its liquid form, and it only hardens in very severe cold temperatures. It is silvery white in colour, and is used for covering the backs of looking-glasses, and for filling barometer and thermometer tubes.

A more important metal than any of the above is IRON. Its great value is scarcely imagined, because we have it so often before us; but should it at any time entirely disappear from the world, its immense importance would then be appreciated, for all trade and commerce would at once come to an end. Iron is as indispensable as water, bread, and salt; and although it has not the rich appearance of gold and silver, and quickly rusts and may be easily destroyed, it is yet the metal which is most widely spread over the face of the globe. Its destruction by air and weather may be prevented by applying proper coatings by which to preserve it. Iron is not found in a pure state, but always mixed with other metals variously known as magnetic iron, red iron ore, brown iron ore, chromic iron, iron spar, manganite, etc. Iron also enters largely into the composition of the aerolites which now and then fall from the heavens. It is used for the manufacture of steel, and is worked in various ways as cast and wrought iron. It is found in all countries of the globe, and thousands of men are occupied in bringing it to the surface of the earth.

The beautiful brown-red metal which we call COPPER

loses its lustre quickly, is soon rusted, and may be quite corroded by sour acids. From this metal verdigris is obtained, which yields a beautiful bluish-green colour, but is very poisonous. Copper kitchen vessels are therefore generally tinned. Besides being used for kitchen utensils, it is also employed for alloying gold and silver. Copper plates are used for covering the outside of ships.

Other artificial metals are manufactured by the alloying of copper with other metals. Brass is formed from an alloy of copper and zinc ; from copper and tin we obtain bell-metal, of which bronze ornaments and cannon are sometimes cast, although steel is now mostly used for the latter. Copper is found in Europe, Asia, and America, mixed with other metals, and generally in the ancient rock formations. The best-known copper ores comprise red oxide of copper, copper pyrites, copper glance, variegated copper ore, grey copper ore, malachite, cinnabar, etc.

TIN is of a silver-white colour, which it quickly loses when exposed to the air, when it becomes black. It is soft, and can be easily melted. It does not rust, and is, consequently, used for the manufacture of solder. Tin is not found in a pure state, but always mixed with other minerals, especially earths. It is found in Bohemia and Saxony, Italy, Mexico, and the West Indies. The best tin, however, is the English tin. Minerals containing tin are called simply tin-stones.

To the antimonies belong the following three minerals :

1. ANTIMONY, which is white and easily melted. It is rarely found in crystals, but more often in a bean-shape form.

2. ARSENIC is a most powerful poison, and is found in silver, lead, and antimony.

3. BISMUTH is found with cobalt, nickel, and silver.

To the group of the zinc minerals belong sulphite of zinc, sulphate of zinc, and siliceous zinc ore. To the cobalt group belong pyrites of cobalt, white cobalt, nickel of copper, white arseniurate of nickel.

LEAD has the same qualities as tin. It is very soft and easily melted, but has a dark-grey colour and a considerable weight. It is very poisonous, and is used in the manufacture of various articles, especially of red lead and white lead. It is seldom found pure, but generally in beds, veins, and layers, mixed with sulphur, antimony, arsenic, iron, and even gold and silver. It occurs in nearly all European countries, and is used for the preparation of litharge, white litharge, tubes, roofing plates, and for the adulteration of tin.

We will now close our book with a few

Hints on the Arrangement of a Mineral Collection.

The mineralogist will require as his tools a good hammer or mallet, and a chisel for breaking or splitting the stones and for chiselling out the minerals from rocks; for carrying the specimens he will also require a knapsack, or a simple linen bag. The best places in which to find minerals are mines and the districts round about them; but stone-quarries and sand pits, railway and road cuttings, and river banks also yield useful and sometimes valuable minerals. The collector will obtain better results when he has obtained some acquaintance with the various branches of mineralogy. If he is well informed upon the succession of the various strata, and has the leading points of geology at his finger ends, he will be much more successful than when this is not the case. But practice is after all the chief thing, and the collector of

minerals must also be handy in the management of his hammer. He should first begin with the rocks nearest to him, and should overlook nothing which may be in any way useful for his collection. Should he afterwards discover that he has collected many specimens of no value, he can throw them out of the window ; but should the collector set himself the task of collecting nothing but curiosities, all his trouble will lead to nothing, and his collection will be of no value. Larger specimens should be wrapped up in paper ; but small and valuable examples, and especially the brittle crystals, are best carried in little cases filled with wadding. On getting home he should wash his specimens with water, with the aid of a brush. Of the minerals he should pick out, as far as possible, pieces of the same size. The specimens of rocks he should clean with a knife and needle from all substances clinging to them. In order to discover the names of his specimens, it would be better always to apply to an experienced geologist. Individual specimens should either be put away in drawers divided into partitions, or placed in small boxes and afterwards labelled ; the label giving the name, the place where they were found, and, if possible, the formation. The whole collection should be kept free from damp and dust.



INDEX.

- Adder, 114.
 Adderwort, 233.
 Adjutant Bird, 105.
 Agate, 248.
 Ai, 54.
 Albatross, 106.
 Alder Tree, 196.
 Algæ, 133.
 Alligator, 109.
 Aloe, Water, 132.
 Alum, 249.
 Amber, 248.
 Amethyst, 248.
 Anemone, 229.
 Animal Kingdom, 17.
 Anise Seed, 215.
 Ant Lion, 174.
 ,, Bear, 55.
 ,, Eater, 55.
 ,, Wood, 151.
 Anthriscus, 231.
 Antimony, 253.
 Apple Tree, 189.
 Apricot, 191.
 Aquarium, 130.
 Argil Clay, 250.
 Argonaut, 182.
 Argus Pheasant, 97.
 Armadillo, 54.
 Arsenic, 253.
 Arum, 229.
 Ash Tree, 195.
 Asparagus, 215.
 Asphalt, 248.
 Aster, 220.
 Auricula, 220.
 Badger, 43.
 Balsam, 220.
 Barb, 120.
 Barbel, 121.
 Barberry, 207.
 Barley, 236.
 Bastard Saffron, 219.
 Bat, 24.
 ,, Colugo, 25.
 ,, Vampire, 25.
 Beaked Chætodon, 120.
 Bean, 215.
 Bear, Ant, 55.
 ,, Brown, 45.
 ,, Polar, 44.
 Beaver, 48.
 Bee, Hive, 148.
 ,, Humble, 150.
 Beech Tree, 193.
 Bee-eater, 141.
 Beet Sugar, 218.
 Beetle, Bark, 145.
 ,, Bastard Land, 134.
 ,, Burying, 137.
 ,, Calosoma, 135.
 ,, Colorado, 214.
 ,, Coriaceus, 135.
 ,, Dermestes, 137.
 ,, Dung, 138.
 ,, Fir-bark, 142.
 ,, Fuller, 140.

- Beetle, Gold, 135.
 " Ground, 135.
 " Hister, 137.
 " Lentil, 141.
 " Musk, 145.
 " Musk Oak, 145.
 " Nasicornis, 140.
 " Pea, 141.
 " Rove, 136.
 " Seed, 141.
 " Spotted, 135.
 " Stag, 138.
 " Tiger, 134.
 " Tiger Wood, 135.
 " Violet Ground, 135.
 " Water, 135.
 Bell Metal, 253.
 Bilberry, 205.
 Birch, 194.
 Bird of Paradise, 90.
 Bird's-foot Trefoil, 221.
 Bismuth, 254.
 Bison, American, 64.
 " European, 64.
 Bittern, 104.
 Bitumen, 248.
 Black Arches Moth, 164.
 Blackbird, 86.
 Blackcap Warbler, 84.
 Bleak, 121.
 Blindworm, 110.
 Blood Lice, 174.
 Bluebottle, 173.
 Boa-constrictor, 114.
 Bole, 250.
 Borax, 249.
 Bovista nigrescens, 241.
 Brass, 253.
 Bread-fruit Tree, 213.
 Bronze, 253.
 Buckwheat, 221.
 Bug, Bed, 173.
 " Tree, 173.
 " Water, 174.
 Burdock, 233.
 Bustard, 102.
 Butcher Bird, 83.
 Butterfly, Apollo, 157.
 " Brimstone, 157.
 " Blue Fritillary, 158.
 " Brown Argus, 158.
 " Cabbage, 157.
 " Camberwell Beauty, 159.
 " Deilephila, 160.
 " Hawthorn, 157.
 " Melanagria, 160.
 " Painted Lady, 159.
 " Peacock, 158.
 " Red Admiral, 159.
 " Silver-washed Fritillary, 159.
 " Swallow-tail, 154.
 " Tortoiseshell, 158.
 Butter-flower, 231.
 Cabbage, 214.
 " Savoy, 215.
 " Summer, 215.
 " Winter, 215.
 Camel, 58.
 Camomile, 233.
 Campanula, 230.
 Cantharellus, 242.
 Capercailzie, 94.
 Carbuncle, 248.
 Caret Turtle, 108.
 Carp, 120.
 Cat, 31.
 " Pole, 40.
 Cauliflower, 215.
 Celandine, 233.
 Celery, 215.
 Centaury, 229.
 Centipede, 179.
 Chætodon, Beaked, 120.
 Chaffinch, 87.
 Chalcedony, 248.
 Chameleon, 113.
 Chamois, 63.
 Chatterer, Waxen, 89.
 Cheese-hopper, 173.
 Cherry, Agriot, 198.
 " Bird, 207.

- Cherry, Common, 190.
 Chickweed, 232.
 Chicory, 218.
 Chimpanzee, 20.
 Chrysomela, Asparagus, 146.
 " Poplar, 146.
 " Red-foot, 146.
 Cinnabar, 253.
 Clay, Argillaceous, 249.
 Clematis, 209.
 Clove Tree, 210.
 Clover, 220, 221.
 Clytus Arcuatus, 146.
 Coal, 247.
 Cobalt, 254.
 " Pyrites, 254.
 Cochineal Insect, 174.
 Cockchafer, 138.
 Cockroach, 175.
 Cocoanut Palm, 209.
 Cod, 123.
 Coffee Tree, 210.
 Colorado Beetle, 214.
 Condor, 74.
 Coot, 103.
 Copper, 252, 253.
 " Glance, 253.
 " Oxide of, 253.
 " Pyrites, 253.
 Coral, 187.
 Corn Moth, 168.
 Corncockle, 233.
 Cornel Tree, 208.
 Cornflower, 233.
 Corundum, 248.
 Cotton Plant, 216.
 Crab, Edible, 180.
 " Variegated, 180.
 Crane, 101.
 " Demoiselle, 103.
 Cray Fish, 180.
 Cress, Garden, 215.
 " Water, 215.
 Cricket, Field, 175.
 " Mole, 176.
 Crocodile, 109.
 Crocus, 220.
 Crossbill, 87.
 Crow's-foot, Bitter, 232.
 " Marsh, 221.
 Crystal, Rock, 248.
 Cuckoo, 19.
 " Flower, 231.
 Cumin, 231.
 Currant Bush, 205.
 Cypress, 201.
 Dachshund, 36.
 Dahlia, 220.
 Daisy, 231.
 " Dog, 231.
 Damson Tree, 191.
 Dandelion 131.
 Darnel, 227.
 Date Palm, 209.
 Deadly Nightshade, 223.
 Death's-head Moth, 160.
 Deer, Fallow, 61.
 " Red, 61.
 Demoiselle Crane, 103.
 Diamond, 247.
 Dill, 215.
 Dogs, Airedale Terrier, 36.
 " Basset-hound, 36.
 " Beagle, 36.
 " Black Spaniel, 36.
 " Bloodhound, 35.
 " Clumber Spaniel, 36.
 " Collie, 37.
 " Dachshund, 36.
 " Dalmatian, 37.
 " DandieDinmont Terrier
 36.
 " English Water Spaniel,
 36.
 " Foxhound, 36.
 " Fox Terrier, 36.
 " Harrier, 36.
 " Irish Terrier, 36.
 " " Water Spaniel, 36.
 " King Charles Spaniel, 37.
 " Lurcher, 36.
 " Mastiff, 36.
 " Newfoundland, 36.

Dogs, Norfolk Spaniel, 36.
 " Otter-hound, 36.
 " Pomeranian, 37.
 " Poodle, 37.
 " Pug, 37.
 " St. Bernard, 36.
 " Skye Terrier, 36.
 " Sussex Spaniel, 36.
 Dog's Parsley, 223.
 Dogwood, 208.
 Dolphin, 72.
 Donkey, 57.
 Douc, 21.
 Dromedary, 58.
 Dove, 94.
 " Turtle, 93.
 Dragon Fly, 176.
 Drill, 23.
 Duck, Domestic, 107.
 " Wild, 107.
 Duckweed, 132.
 Dung Beetle, 138.

 Earth Worm, 181.
 Earwig, 175.
 Eater, Ant, 55.
 Eel, 127.
 " Electric, 127.
 Elder Tree, Black, 206.
 Elephant, 64.
 Elk, 60.
 Elm, 196.
 Elodea, 132.
 Emerald, 248.
 Emery, 249.
 Endive, 215.
 Epsom Salts, 249.
 Ermine, 40.
 Euchroma, 140.

 Falcon, 75.
 Fallow Deer, 61.
 Feldspar, 249.
 Fennel, 215.
 Fern, Common, 238.
 " Eagle, 238.

Fern Worm, 238.
 Fieldfare, 86.
 Finch, Gold, 87.
 " Green, 87.
 Fir, Scotch, 200.
 " Silver, 196.
 Fish, Gold, 14.
 Flamingo, 105.
 Flax, 216.
 Fluor-spar, 249.
 Fly, 173.
 " Bluebottle, 173.
 " Cheese-hopper, 173.
 " Dragon, 176.
 " Gad, 173.
 " Grey Meat, 173.
 " House, 173.
 " Lantern, 174.
 " Wild Ichneumon, 173.
 Flying Dragon, 110.
 " Fish, 122.
 Forget-me-not, 228.
 Fowls, 97.
 " Bankiva, 97.
 " Bantam, 98.
 " Brahma Putra, 98.
 " Cochin China, 98.
 " Crève-cœur, 98.
 " Domestic, 97.
 " Dorking, 98.
 " Dutch, 98.
 " Guinea, 99.
 " Houdan, 98.
 " Indian, 98.
 " Italian, 98.
 " Spanish, 98.
 Fox, 38.
 Foxglove, 224.
 Fox-tail Grass, 237.
 Frog, Common, 117.
 " Green, 117.
 Frogbit, 132.
 Fuchsia, 220.
 Fuller's Thistle, 218.

 Gad Fly, 173.
 Galicum silvaticum, 228.

- Gall Insect, 153.
 Garden Sleeper, 47.
 Gecko, 110.
 Gentian, 230.
 Geranium, 220.
 Giant Euchroma, 140.
 " Kangaroo, 46.
 Giraffe, 60.
 Glance, Copper, 253.
 " Zinc, 254.
 Glauber Salts, 249.
 Glow-worm, 140.
 Gnat, 173.
 Goat, 62.
 Goat's-foot, 231.
 Goat-sucker, 92.
 Gold, 251.
 " Finch, 87.
 " Fish, 121.
 Goose, Stubble, 107.
 " Wild, 107.
 Gooseberry Bush, 204.
 Gorilla, 21.
 Goshawk, 75.
 Graphite, 247.
 Grasses, Fox-tail, 237.
 " Timothy, 237.
 " Ray, 237.
 Grebe, Crested, 106.
 Greenfinch, 87.
 Groundsel, 232.
 Grouse, Black, 94.
 " Heath, 94.
 Guinea Fowl, 99.
 Gull, Laughing, 106.
 Gypsum, 249.
 Gypsy Moth, 163.

 Haddock, 124.
 Haliotis, 184.
 Hamster, 52.
 Hare, 52.
 " Sea, 184.
 Hawk, Sparrow, 75.
 Hawthorn, 206.
 Hazel Tree, 192.
 Heather, 229.

 Hedgehog, 28.
 Hedge Sparrow, 84.
 Hellebore, Black, 222.
 " Green and Stink-
 ing, 222.
 Hemlock, 222.
 Hemp, 215.
 Henbane, 223.
 Heron, 102.
 Herring, 121.
 Hippopotamus, 67.
 Honeysuckle, 208.
 Hoopoe, 91.
 Hops, 217.
 Hornbeam, 194.
 Hornblend, 249.
 Hornwort, 132.
 Horse, 55.
 " Chestnut, 198.
 Horse-tail Grass, 238.
 House Fly, 173.
 Howling Monkey, 23.
 Humming-bird Moth, 163.
 Hyacinth, 220.
 Hyæna Dog, 33.
 " Spotted, 33.
 Hylotrupes bajulus, 146.

 Ianthine, 183.
 Ibex, 63.
 Ibis, 104.
 Ichneumon, 39.
 " Fly, 151.
 Iguana, 110.
 Iron, 252.
 Ivy, 208.

 Jackal, 37.
 Jaguar, 32.
 Jay, 90.
 Jer-falcon, 75.
 Juniper Tree, 200.

 Kangaroo, Giant, 46.
 " Rat, 51.

 Lady Bird, 146.

- Lama, 59.
 Lamia textor, 146.
 Lamprey, 130.
 Lantern Fly, 174.
 Lapwing, 104.
 Larch, 200.
 Lark, 89.
 Larkspur, 233.
 Lead, 254.
 Leaf Lice, 174.
 Leech, 181.
 Leek, 215.
 Lemming, 51.
 Lemon, 190.
 Lentil, 215.
 Lettuce, 215.
 Lice, Blood, 174.
 " Leaf, 174.
 " Plant, 174.
 Lilac, 208.
 Lily, 220.
 " of the Valley, 228.
 Limestone, 249.
 Lime Tree, 194.
 Limpet, Edible, 184.
 Lion, 29.
 " Ant, 174.
 Liquorice Plant, 219.
 Litharge, 254.
 Liverwort, 228.
 Lizard, Sand, 109.
 Loach, 121.
 Lobster, 181.
 Locust, Green Leaf, 175.
 " Migratory, 175.
 Lucerne, 221.
 Lungwort, 228.
 Lynx, 33.
 Magnesium, 249.
 Magpie, 90.
 " Moth, 168.
 Maize, 237.
 Malachite, 253.
 Mallard, 107.
 Mallow, 233.
 Mandril, 22.
 Mangel wurzel, 218.
 Manis, Long-tailed, 55.
 Maple, 195.
 Marble, 249.
 Marmot, 48.
 Marsh Crow's-foot, 221.
 " Snail, 183.
 Marten, House, 40.
 " Tree, 39.
 Mask Snail, 182.
 May Fly, 175.
 " Worm, 141.
 Meadow Saffron, 227.
 " Sage, 230.
 " Sweet, 231.
 Meerschaum, 249, 250.
 Mercury, 252.
 Mezereon, 224.
 Mica, 249.
 Mignonette, 220.
 Milfoil, 132.
 Milkwort, 228, 231.
 Millet, 237.
 Minerals, 244-55.
 Minnow, 121.
 Mitella, 183.
 Mole, 26.
 Monkey, Howling, 23.
 Monk's-hood, 223.
 Moril, Edible, 241.
 " Poisonous, 241.
 Moss, Hair, 238.
 " Peat, 241.
 " Reindeer, 241.
 Moth, Agrotis, 167.
 " Black Arches, 164.
 " Catocala fraxini, 167.
 " " nupta, 167.
 " Corn, 168.
 " Death's-head, 160.
 " Great Winter, 168.
 " Green Owl, 167.
 " Gypsy, 163.
 " Humming-bird, 163.
 " Lasiocampa quercifolia,
 165.
 " Macroglossa, 163.

- Moth, Magpie, 168.
 " Pine Spinner, 165.
 " Poplar Sphinx, 160.
 " Procession, 166.
 " Pterophorus, 168.
 " Satyrus Hermione, 160.
 Moulds, 242.
 Mouse, 51.
 Mud Fish, 121.
 " Tortoise, 108.
 Mule, 57.
 Muscardine, 165.
 Mushroom, 241.
 Musk Ox, 59.

 Narcissus, 220.
 Nautilus, 182.
 Nettle, Common, 233.
 " Purple, 232.
 " Spotted, 232.
 " White, 232.
 Newfoundland Dog, 37.
 Nickel, 254.
 Nightingale, 83.
 Nightshade, 223.
 Nuthatch, 91.

 Oak, 192.
 Oats, 236.
 Ochre, 250.
 Onion, 215.
 Opal, 248.
 Ophura, 187.
 Orange, 190.
 Orang-outan, 19.
 Orchis, 239.
 Origanum, 232.
 Oriole, 83.
 Osprey, 74.
 Ostrich, 99.
 Otter Fish, 40.
 Owl, Brown, 77.
 " Eagle, 77.
 " Long-eared, 77.
 " Short-eared, 77.
 " Snowy, 77.
 " White, 77.

 Ox, 64.
 " Musk, 59.
 Oxide of Copper, 253.
 Oyster, 184.
 Oyster-catcher, 104.

 Palm Tree, Cocoonut, 209.
 " " Date, 209.
 " " Sago, 209.
 " " Sugar, 209.
 Pansy, 220, 233.
 Papion, 21.
 Paris quadrifolia, 227.
 Parrot, Grey, 78.
 " Wrasse, 120.
 Partridge, 94.
 Parsley, 215.
 " Dog's, 223.
 Passion Flower, 220.
 Pea, 215.
 Peach Tree, 191.
 Peacock, 98.
 Pear Tree, 189.
 Peat Moss, 241.
 Pelican, 105.
 Pepper Plant, 209.
 Perch, 119.
 Petroleum, 248.
 Phatagin, 55.
 Pheasant, Argus, 97.
 " Common, 97.
 " Gold, 97.
 Pholas, 184.
 Phylloxera, 174.
 Physalis, 187.
 Pig, 68.
 Pigeon, Carrier, 93.
 " Fantail, 93.
 " Oriental, 93.
 " Rock, 93.
 " Ruff, 93.
 " Tumbler, 93.
 " Turbit, 93.
 " Turkish, 93.
 " Trumpeter, 93.
 Pike, 122.
 Pine, 199.

- Pine Spinner, 165.
 „ Weymouth, 201.
 Pink, 220.
 Plane Tree, 198.
 Plantain, 231.
 Platinum, 250.
 Plover, Green, 104.
 Plum Tree, 190.
 Pole Cat, 40.
 Pomeranian Dog, 35.
 Poodle, 37.
 Poplar, Black, 197.
 „ Pyramidal or Italian,
 197.
 „ Trembling, 196.
 „ White, 197.
 Poppy, Garden, 219.
 „ Red, 219, 233.
 Porcelain, 249, 250.
 Porcupine, 50.
 Porret, 215.
 Potato, 214.
 Potter's Clay, 250.
 Pouch, Shepherd's, 232.
 Praying Mantis, 175.
 Primrose, 220.
 Privet, 207.
 Proteus, 118.
 Ptarmigan, 94.

 Quail, 97.
 Quaking Grass, 237.
 Quartz, 248.
 Quicksilver, 252.
 Quince, 190.

 Rabbit, 53.
 Raccoon, 44.
 Raspberry Bush, 205.
 Rat, Brown, 51.
 „ Domestic, 51.
 „ Norway, 51.
 Rattlesnake, 113.
 Ray Grass, 237.
 Redstart, 85.
 Reindeer, 60.
 „ Moss, 241.

 Rellmouse, 48.
 Rhinoceros, 67.
 Rice, 236.
 Ring Dove, 93.
 Roach, 121.
 Robin Redbreast, 85.
 Rock Oil, 248.
 Rook, 90.
 Rose, Garden, 208.
 „ Wild, 208.
 Rushes, 237.
 Rye, 234.

 Saffron, Bastard, 219.
 „ Meadow, 227.
 Sage, Meadow, 230.
 Sago Palm, 209.
 Sainfoin, 221.
 Salamander, 118.
 Sal-ammoniac, 249.
 Salmon, 124.
 „ Trout, 127.
 Salt, 249.
 Saltpetre, 249.
 Salts, Epsom, 249.
 „ Glauber, 249.
 Sand Lizard, 109.
 Saw Fish, 129.
 Scabious, 230.
 Scallop, Great, 184.
 Scorpion, Book, 179.
 „ European, 179.
 Sea Bat, 119.
 „ Bream, 119.
 „ Surgeon, 119.
 „ Urchin, 187.
 Seal, 68.
 Sepia, 182.
 Serpentine, 249.
 Sertularia, 188.
 Setter, 35.
 Shark, White, 129.
 „ Hammer-headed, 129.
 Shave Grass, 233.
 Sheat Fish, 123.
 Sheep, 62.
 Shell Fish, Striped, 184.

- Shepherd's Pouch, 232.
 Shrew, Dwarf, 28.
 " Mouse, 28.
 " Water, 28.
 Shrike, Great, 80.
 Silkworm, 164.
 Silver, 251.
 Sleeper, Garden, 47.
 Sloe, 206.
 Sloth, 54.
 Smut, 242.
 Snail, Edible, 182.
 " Great Water, 183.
 " Marsh, 183.
 " Mask, 182.
 Snake, Grass, 114.
 Snowdrop, 220.
 Soda, 249.
 Solder, 253.
 Sorrel, Sour, 232.
 " Wood, 229.
 Spanish Fly, 141.
 Spar, 249.
 Sparrow, 88.
 " Hawk, 75.
 Spelt, 236.
 Sphinx, Poplar, 160.
 Spider, Garden, 179.
 Spindle Tree, 207.
 Spinel, 249.
 Sponge, 188.
 Spring-tail, 146.
 Squirrel, 47.
 Stag, 61.
 Starling, 90.
 Starwort, 132.
 Steel, 252.
 Stickleback, 120.
 Stock Dove, 93.
 Stork, 101.
 Strombus, 183.
 Sturgeon, Common, 128.
 " Huso, 128.
 " Lichtenstein, 128.
 " Red, 128.
 Suck-stone, 121.
 Sugar Beet, 218.
 Sugarcane, 237.
 Sulphate of Zinc, 254.
 Sulphur, 246.
 Swallow, 92.
 Swan, Mute, 106.
 " Song, 106.
 Sweet, Meadow, 231.
 Swine, Domestic, 68.
 " Wild, 68.
 Syringa, 208.
 Talc, 249.
 Tamanoir, 55.
 Tansy, 233.
 Tape Worm, 181.
 Tapir, 68.
 Tea Plant, 210.
 Tench, 121.
 Termites, 176.
 Tern, 105.
 Terrarium, 115.
 Thistle, Fuller's, 218.
 Thorn Apple, 224.
 Thrush, Missel, 86.
 " Song, 85.
 " Wind, 86.
 Thyme, Wild, 231.
 Tiger, 31.
 Timothy Grass, 237.
 Tin, 253.
 Titmouse, 86.
 " Blue, 86.
 " Fen, 86.
 " Great, 86.
 Toad, Common, 118.
 " Laughing, 118.
 Toadstool, 241.
 Tobacco, 218.
 Topaz, 248.
 Tormentil, 228.
 Tortoise, 108.
 Toucan, 78.
 Tree Bug, 173.
 " Creeper, 91.
 " of Life, 201.
 Trefoil, 221.
 Trichinosis, 181.

- Trifolium, 230.
 Trout, 127.
 " Lake, 127.
 " Salmon, 127.
 Tube Worm, 181.
 Tulip, 220.
 Turkey, 99.
 Turtle, Caret, 108.
 " Giant, 108.
 " Dove, 93.

 Umber, 250.
 Urchin, Sea, 187.
 Urus, 64.
 Utricularia, 132.

 Valerian, 230.
 Vallisneria, 132.
 Vegetable Kingdom, 189.
 Verbascum, 233.
 Vetch, 221.
 Vine, 203.
 Violet, 229.
 Viper, 114.
 Virginian Climber, 220.
 Vulture, 74.

 Wagtail, 81.
 Walnut Tree, 191.
 Wall Rue, 238.
 Walrus, 71.
 Wasp, Common, 150.
 " Wood, 154.
 Water Bug, 174.
 " Elder, 208.
 " Ousel, 83.
 Waxen Chatterer, 89.
 Weasel, 40.
 Weed, Duck, 132.
 Weevil, Acorn, 142.
 " Apple, 142.

 Weevil, Branch, 142.
 " Brown, 142.
 " Corn, 142.
 " Fruit, 142.
 " Leaf, 142.
 " Nut, 142.
 " Oak, 142.
 " Palm, 142.
 " Plum, 142.
 " Poplar, 142.
 " Vine, 142.
 Wentletrap, 183.
 Whale, 72.
 Wheat, 235.
 Wheatear, 83.
 Whelk, Marble, 183.
 " Spider, 183.
 Willow, 197.
 " Silver, 198.
 " Weeping, 198.
 Wolf, 33.
 Woodbine, 208.
 Wood, Dog, 208.
 Woodcock, 103.
 Woodpecker, Black, 79.
 " Green, 79.
 " Spotted, 79.
 Woodruff, 228.
 Wood Sorrel, 229.
 Wool Grass, 237.
 Worm, Earth, 181.
 " Tape, 181.
 " Tube, 181.
 Wren, Common, 85.
 " Golden-crested, 84.

 Yellow-hammer, 86.
 Yew Tree, 201.

 Zebra, 58.
 Zinc, 253.

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